

PUBLIC WORKS

Dec.
1958

CITY, COUNTY AND STATE

**New System for
RECORDS RETENTION
Needs Needleless Storage**
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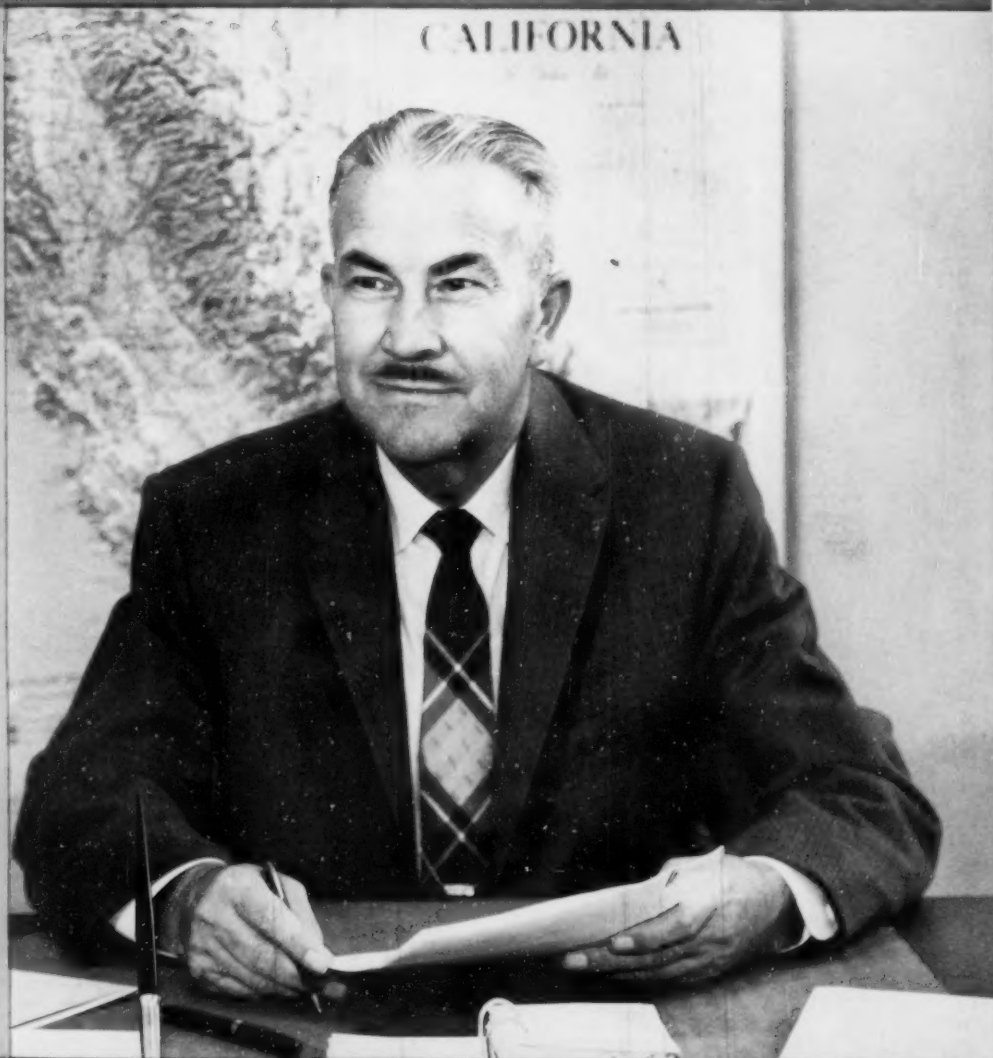
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P. H. McGauhey is Director of the Sanitary Engineering Laboratory and Professor of Sanitary Engineering at the University of California. He has been a leader in many areas of research. For more data see page 18.



Them was the days...

Things just haven't been the same since they put in these *new-fangled* chlorinators. Joe... fellow that used to take care of the chlorinators... he was shifted to the pumps. Hardly ever get to see him at all anymore.

Then, where they used to have a whole slew of chlorinators, now they only have half as many. Something about "reliability"

Well, I don't know about this reliability stuff. Don't have too good a grasp of maintenance either. But it sure does get lonely around here nowadays. Even the *smell* is gone!*

Personally, I happen to like the old-fashioned way of doing things. But it seems like everybody turned against me the day Fischer & Porter started making chlorinators.

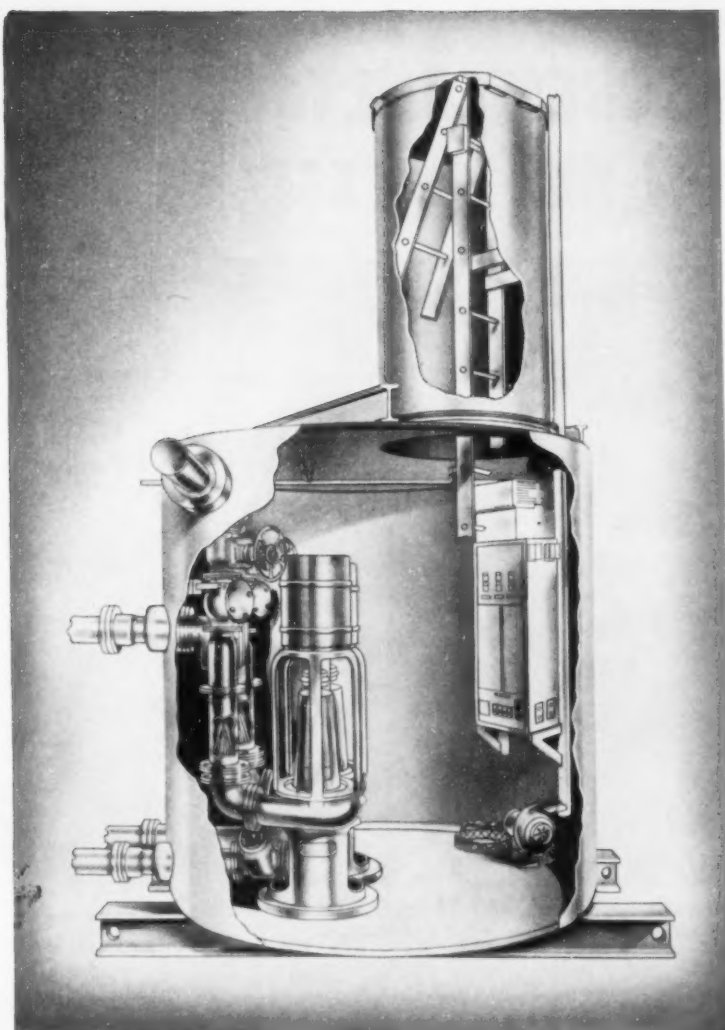
If you like the old-fashioned way, all well and good. But if you don't, perhaps you'd better get the facts on new-fashioned chlorinators from Fischer & Porter Company, 628 Fischer Road, Hatboro, Pennsylvania.



FISCHER & PORTER CO.

Instrumentation and Chlorination

*Any wonder everyone's trying to copy F&P's design now?



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HERE'S WHY COLCHESTER, N.Y., NOW HAS TWO D6s



Caterpillar D6 Tractor with No. 6A Bulldozer works on a one-mile road rebuilding job near Colchester, N. Y. Cat No. 955 Traxcavator is loading a truck in the background.

The town of Colchester, N. Y., recently bought its second Caterpillar D6 Tractor. The first is 10 years old. "Since we bought that D6," says Harry M. Shaw, superintendent, "we have had no down time except for normal replacement of worn parts. Our new D6 is just as rugged and we expect just as much of it."

The D6 has proven its power and versatility in thousands of municipalities. With 5 forward speeds and 4 reverse, the 93 HP D6 develops 19,000 lb. maximum drawbar pull. The long-lived oil clutch is standard equipment.

One feature of the D6 that is particularly popular is a simple hydraulic unit that takes the effort out of steering.

Your Caterpillar Dealer will be glad to demonstrate on your roads the track-type tractor that's right for your municipality. And his reliable parts and service stand back of your investment.

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.



"Ten years of top performance from our D6," says Superintendent Harry M. Shaw. Town of Colchester now has two D6s in its 100 per cent Caterpillar team.

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WITH CAT-BUILT MACHINES**



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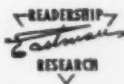
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Public Works T. M. Reg. U.S. Pat. Off.
Established 1896

Published Monthly by Public Works Journal Corporation, Office of Publication at Orange, Conn. Editorial and Advertising offices at 200 So. Broad St., Ridgewood, New Jersey. Subscription rates: U.S.A. and possessions, \$5.00; Canada and South America, \$6.00; All other countries, \$7.00. Accepted as controlled circulation publication at Orange, Conn.

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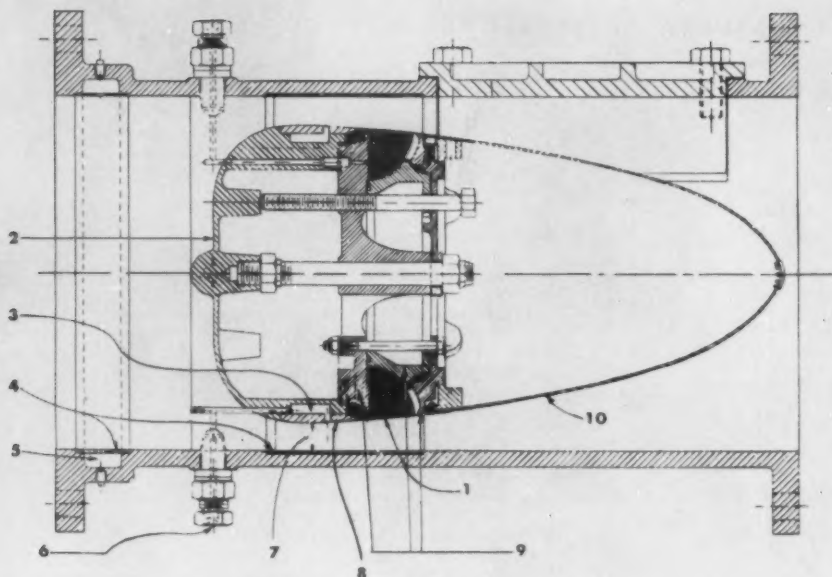
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THE MOST USEFUL ENGINEERING MAGAZINE FOR CITIES, COUNTIES AND STATES



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| 1. Only moving part is this modulator. | 6. Low-pressure connection. |
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POINT OF VIEW

Research is Essential to Progress in the Public Works Field

IN THIS ISSUE considerable space is devoted to research activities. To some, perhaps, a portion of this space will seem to treat of matters far removed from present-day needs and procedures. Possibly this is so, yet a surprising number of new and improved devices and practices, developed from the research outlined here, will be standard in the next couple of years.

Most of the space in this issue is devoted to sanitary engineering. Research and development is perhaps even more intensive in other fields. In fact, so outstanding and so rapid has been the progress in highway research that we have reported on this from month to month. To cover that field by any once-a-year series would be impossible.

This is not to say that all sanitary engineering research is covered in this issue; it has been possible to present only the highlights. Our purpose, rather, has been to make all public works engineers conscious of the scope, the needs for and the great returns available from research and development.

More Consulting Engineers Should Take Part in Water Works Convention Activities

LOOKING AT THE over-all attendance of the big water works conventions, we have been somewhere between impressed and concerned by the make-up of the registrants. This, in turn, is a reflection of the membership. While the attendance may be neck-and-neck between the "old guard" water works operating heads and manufacturer's salesmen, it is a third group that we have in mind. That is the engineers who design the water works projects, the consulting engineers who have as much as any to gain by active membership and active participation. These men can be an asset to the convention programs and the programs can be an asset to them, both in their contacts with water works officials and in getting the papers and talks at the level of the greatest good for the largest number.

This is not meant to minimize the valuable contributions of larger consulting engineering firms—and it is not a bid for the indiscriminate recruiting of the smaller; it is aimed at a better balance. It

would be a wonderful and rewarding thing if such added activity could result in a thousand more engineers at these national gatherings. The whole framework of the industry would be strengthened in numbers and in abilities. It could be one of the essential elements in the effectiveness of the present public relations program.

Well-Planned Buildings Can Add to Public Works Activity Efficiency

MANY PUBLIC works departments are burdened by over-age and inefficient garage facilities. There has been gratifying progress in mechanization during the past decade and it is conservative to say that our highway departments are dependent for effectiveness on uninterrupted operation of motorized equipment. The same is true of other public works activities.

These conditions necessitate well-planned facilities for storage, operation, maintenance and repair. Convenient location; modern buildings; a reasonable degree of centralization of repair and maintenance facilities, resulting in a reduction in parts inventories; well-planned layouts; protection of equipment—these are all essential to our modern public works activities. The initial cost will, in many cases, be returned many times over through more efficient operation.

Increasing Needs for Power—And For Water

IT HAS BEEN estimated that there are now about 60 power using devices in rather general use in homes as compared to about 20 a generation ago. The number of water-using devices has also increased during the same period, though probably not to the same extent.

In the power utility field, utilities have generally done a good job of supplying the necessary power; the problem has been in the house wiring which, in older homes, will not safely carry the load. In the water field, the problem has been largely in delivering the water to the homes according to the demand.

Remedial measures will cost money in either case, and such measures are needed because the situation otherwise will continue to worsen. There is only one thing to do and that is to get to work.

A Merry Christmas and a Happy New Year to All our Readers

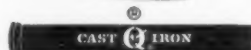
ABILITY . . .



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1. **HIGH FLOW CAPACITY . . .**
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Specify America's #1 pipe and your water system will serve long after the bond issue is retired.

**Here is the proof!*

FLOW FACTORS FOR CEMENT LINED CAST IRON PIPE

LOCATION	SIZE	TEST SECT. IN FEET	VELOCITY F.P.S.	AGE YEARS	W & H "C" FACTOR
Bowling Green, Ohio	20"	45,592	0.7-2.4	New	142.5
Chicago, Illinois	36"	7,200	2.6-3.6	New	147
New Orleans, La.	12"	39,650	1.2-2.9	New	141
Corder, Mo.	8"	21,350	0.9-2.3	New	143
Univ. of Illinois	8"	400	3.14	New	150
Concord, New Hamp.	14"	500	1.7-2.2	New	151
Concord, New Hamp.	12"	500	2.0-3.4	11	142
West Palm Beach, Fla.	12"	500	3.6-5.4	15	139.5
Greenville, S. C.	30"	87,376	2.4-2.7	12	148.5
Corpus Christi, Tex.	30"	65,641	1.1-1.8	6	146
Summerville, S. C.	8"	500	1.98-2.43	13	142.5
Champaign, Illinois	16"	3,920	3.1-5.6	22	139.3

*Available upon request: Booklet containing flow test and tables on Cast Iron Pipe.

pipe

FOR MODERN WATER WORKS

Tips on grade and alignment of Beth-Cu-Loy culvert pipe



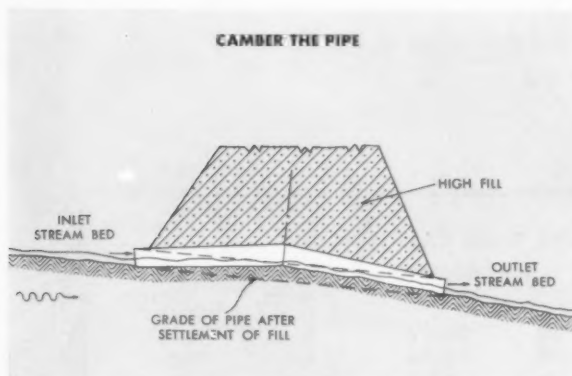
Because of its light weight and resistance to fracture, a culvert pipe made of Beth-Cu-Loy corrugated galvanized sheets is the easiest to install quickly and economically.

However, even with a Beth-Cu-Loy culvert, it pays to plan ahead for best results. Careless installation can undo a good design.

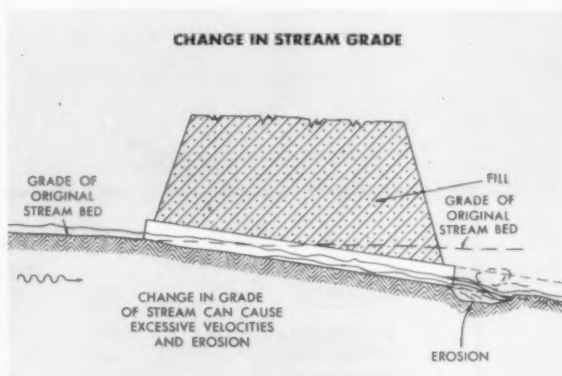
After making a careful study of the area and location, it's best to prepare a detailed plan to show all requirements. Width of highway, shoulders, slope of embankments, height of fill, grade of stream bed, elevation of culvert grade, length of pipe, skew angle, and other factors should be included.

The drawings shown here illustrate several typical culvert installations and grades under fill, with helpful comments covering the essentials in each example. Your own experience could no doubt embellish these cases to a considerable extent.

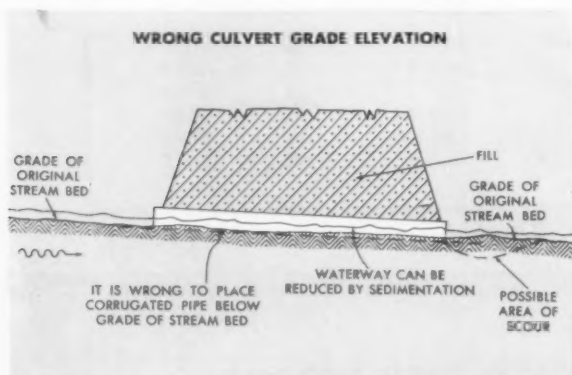
When you specify or order culvert pipe, be sure it is corrugated galvanized steel. Bethlehem does not fabricate this pipe as such, but we do manufacture the galvanized Beth-Cu-Loy sheets which fabricators make into pipe. In all respects Beth-Cu-Loy meets the rigid specs of the AASHO. For further information, write your fabricator for our Booklet 425-A, "Solving Drainage Problems."



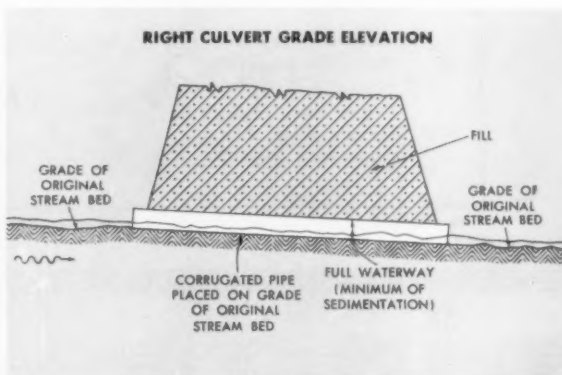
The corrugated steel pipe should always be cambered under a deep fill, so the grade of the pipe will level out with the settlement of the fill.



When the grade is increased in a stream bed and there is danger of excessive erosion at the outlet, the pipe should be continued to the point of disposal.



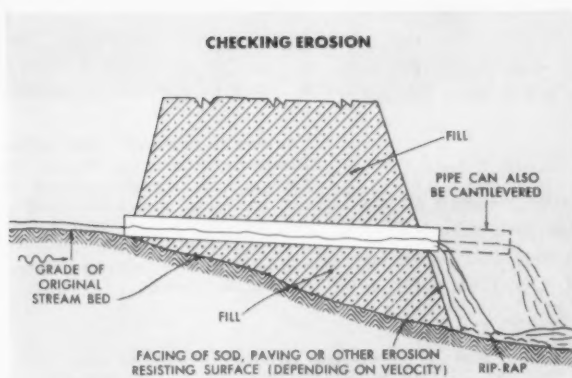
Do not place the pipe below the grade of the original stream bed. When this is done, there are hazards of sedimentation and serious scour at the exit.



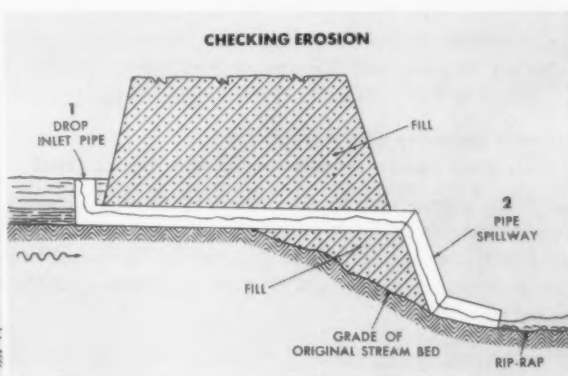
Place the culvert pipe on the same grade as the original stream bed, and without change in the natural slope of the stream, if possible.



Installing a 48-in. asphalt-coated Beth-Cu-Loy culvert under a U. S. highway bypass near Harrisonburg, Va. Note grade of culvert and the precautions taken to assure correct alignment.



Two methods of checking erosion at the exit bank are shown here. The best and most economical solution is to extend the corrugated steel pipe as a cantilever.



Two practical methods of checking soil erosion by the use of (1) a corrugated drop-inlet pipe at the entrance, and (2) a corrugated pipe spillway at the exit.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA. On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation, Export Distributor: Bethlehem Steel Export Corporation

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Correct balance and long-track stability eliminate the need for counterweighting the TD-15 4-In-1. Track length on the ground is a full 98¾ inches!

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on your own roads, streets and public works jobs!**

There's only one way to size-up new TD-15 performance—to measure its job range and capacity—to compare its cost-cutting capabilities to a yard-full of special-purpose rigs. That's to get on the deep-cushioned seat and prove to yourself what it can do. See your International Drott Distributor for a demonstration!



"Concrete-bucking" pry-action break-out breaks up, digs up, and loads out old pavement — gives a big economy advantage to municipalities, over single-action rigs that lack 4-In-1 pry-over-shoe power! The new TD-15 4-In-1 exerts the tremendous break-out force of 42,650 lbs.

As a **"carry-type scraper"** with cutting edge grading-off an even layer, and "boiling" the bucket full, the new TD-15 4-In-1 gives you a multitude of profitable uses. It can grade, strip, spread, or load-in-place a wide variety of materials with amazing accuracy!

International Harvester Company, Chicago 1, Illinois
Drott Manufacturing Corp., Milwaukee 15, Wisconsin



**INTERNATIONAL®
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TD-15



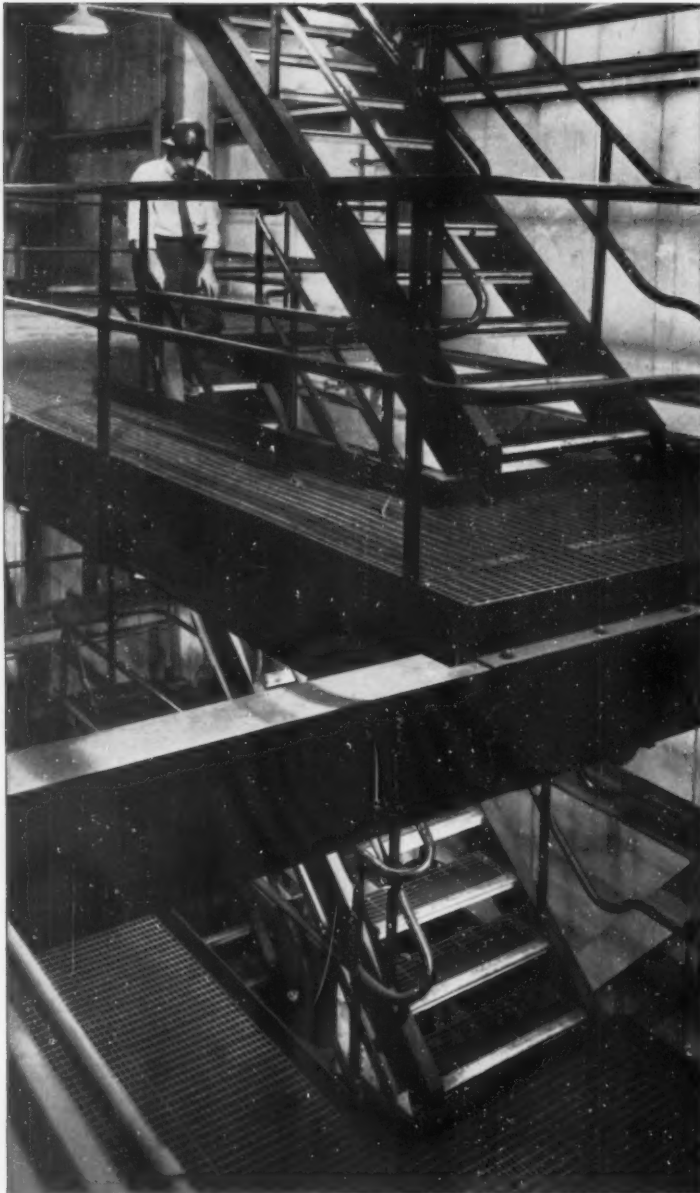
You'd need a heavy-duty blade outfit to match the earth-rolling material-digging performance of the new TD-15 4-In-1! You regulate dozing depth accurately with "radius control," hydraulically, from the tractor seat.



"Back-dragging" with exclusive clamshell action—new TD-15 4-In-1 reduces time and cost of "dressing" a bank—or pulling down material by the truckload! Shuttle-Bar control speeds up back-and-forth cycles on jobs like this!



**Where a misstep costs \$500...
Blaw-Knox Electroforged® Steel Grating
provides safer non-slip footing**



*Stair falls cost industry
over \$60,000,000 a year.*

An average accident amounts to a loss of \$500 in claims.*

A good way to guard against these profit-eating accidents is to construct your stair treads, walkways and floors with Blaw-Knox Electroforged Steel Grating. Non-slip twisted crossbars and a wide variety of bearing bars are available to meet every kind of working condition—safely solving the most hazardous skid situations.

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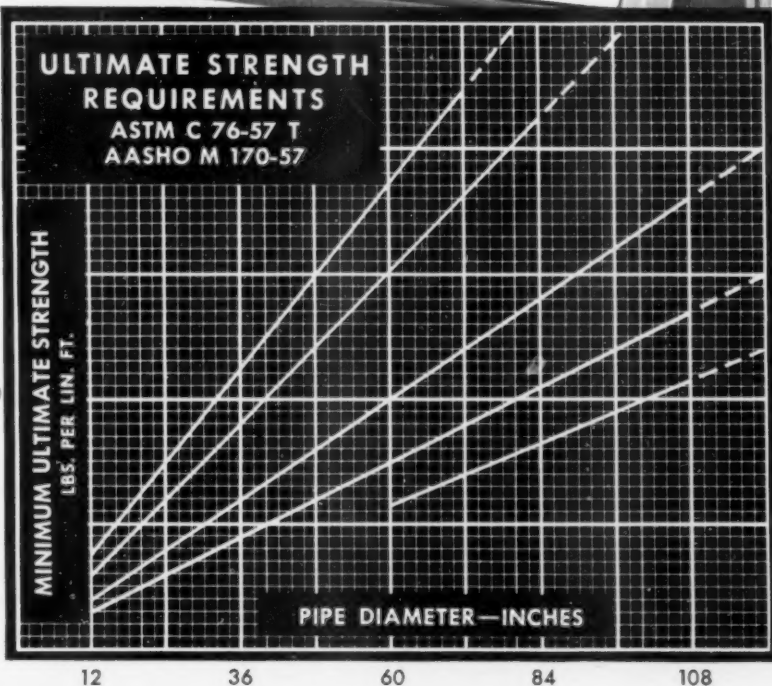


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- Fireproofness—with no need for special pipe lining

Welded wire fabric reinforcement gives you all these extras. And for the best reinforcement, be sure it's USS American Welded Wire Fabric. USS American Welded Wire Fabric is precision manufactured from extra-strong cold-drawn steel wires. And its quality is rigidly controlled to assure you a fabric that meets every specification—exactly—shipment after shipment.

A type for every pipe—USS American Welded Wire Fabric is made in circumferential wire sizes up to and including $\frac{1}{2}$ " at 2", 3", and 4" on centers. For more information, write to American Steel & Wire, 614 Superior Ave., N.W., Cleveland 13, Ohio. *USS is a registered trademark*

USS American Welded Wire Fabric is used all over the world for sanitary and storm sewers, highway and railroad culverts, and for airport drainage.

It pays... to ask, *"is it Reinforced?"*



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One of the new low-cost Barber-Greene Batch Plants in operation. Available in both 1000 and 1500 lb. sizes, these new plants include many years-ahead features.

two new low-cost Barber-Greene Batch Plants with advanced big-plant features

Write for information on these two new profit-building batch plants.

Many advanced features in new low-cost batch plants

Incorporating job-proved advantages of the famous Barber-Greene Batch-Omatics, these two plants also have many new features, including:

- **New Batchometer Asphalt Metering System** automatically meters preset quantity of asphalt to pugmill for each batch.
- **Dyna-Mix Pugmill** for faster mixing, more uniform coating . . . long life, easy maintenance.
- **Quick, Easy Erection** with three-unit design: screen and bin section; weigh-hopper and pugmill section; base section. Tapered pins guide sections into place . . . automatically align all bolt holes.
- **3½ Deck Vibrating Screen**, with 40 sq. ft. of area, gives top capacity for each plant and for the full range of asphalt mixes . . . integral part of bin section for easier erection. Four bins are standard—not extra.
- **Optional Hydraulic Controls** for easier operation . . . relieve operator of manual exertion; easily converted in the field.
- **Hydraulically Operated Pugmill Discharge Gate** provides instant discharge of mix . . . eliminates segregation. No time wasted between batches.
- **Other Advantages Include:** easier maintenance; complete line of accessories, including fines system; combined overflow chutes; scavenger dust system.

58-44-A

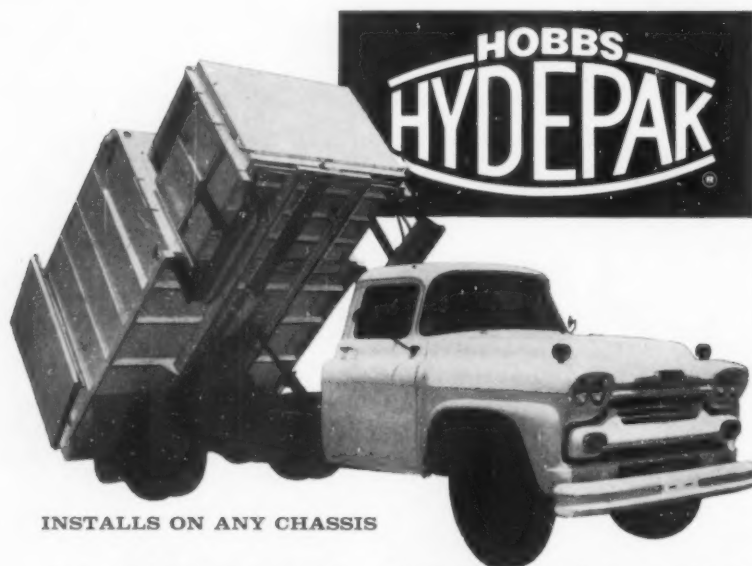
Barber-Greene

AURORA, ILLINOIS, U.S.A.



CONVEYORS...LOADERS...DITCHERS...ASPALT PAVING EQUIPMENT

Greater capacity means fewer trips to dump with



INSTALLS ON ANY CHASSIS

...3 yards more capacity than other refuse packers of comparable weight and cost!

Three yards more *compressible* capacity -- inside the main storage compartment -- means several more blocks can be covered by a Hobbs Hydepak before it's necessary to go to the dump site.

LOOK AT THIS COMPARISON:

*Measurements by an independent testing laboratory for a major Southwestern city.

	Hobbs Hydepak Model 1619	Body G	Body P
Body Volume, cu. yds.	16.2	12.7	12.9
Empty Weight, lbs. (including weight of trucks)	12,180	13,740	12,280

LOAD



COMPRESS



DUMP



Volume, as measured above, is body space into which refuse can be *completely compressed* and does not include the three-yard loading compartment at the front. When you buy a refuse collection body of a given capacity make sure how much of the total volume is really *compressible* volume, and how much is in the loading hopper, where only partial compression is possible. There's a big difference!

Available in 13, 16, 20 and 24 cu. yd. capacities (not including 3-yard loading compartment).

FOR MORE CAPACITY PER TRIP, GET



HYDEPAK is a division of HOBBS TRAILERS, leading manufacturer of truck-trailers and bodies

For full information, write to Hydepak Div., Hobbs Trailers, 609 No. Main, Fort Worth



P. H. McGauhey is Director of the Sanitary Engineering Research Laboratory and Professor of Sanitary Engineering at the University of California. In the first of these capacities it is his responsibility to develop and guide a research facility designed to provide opportunity for advanced graduate instruction and individual study, for professional growth of the teaching faculty and for public service through research. As Chairman of the Hydraulic and Sanitary Engineering Division of the Department of Civil Engineering, his duties include administration and development of a new program of instruction and research in water resources engineering.

Professor McGauhey joined the staff of the University of California as Research Engineer and Assistant Director of the SERL in July, 1951, being promoted to Director in 1957. From 1927 to 1948, he was on the civil engineering staff of Virginia Polytechnic Institute, becoming Professor of Sanitary Engineering in 1941. Following two years in a similar post at the University of Southern California, he returned to VPI in 1950 as Head of the Department of Civil Engineering.

Professor McGauhey holds degrees from Oregon State, VPI, and Wisconsin. He is a member of Tau Beta Pi, Sigma Tau, Chi Epsilon, Phi Kappa Phi, Omicron Delta Kappa, and Sigma Xi. His professional affiliations include the ASCE, AWWA, FSIWA, APHA and ASEE. In these organizations he has served on numerous committees and held a variety of offices. He is a registered professional engineer in two states and is a diplomate of the American Academy of Sanitary Engineers.

Professor McGauhey and his wife live in El Cerrito. Through some thirty years, Professor McGauhey reports, she has encouraged his professional growth, shared his interest in people and in professional society conventions, and tolerated hobbies which at times have filled the basement, attic and study with power tools, photographic paraphernalia, drafting tables and typewriters.



FILE REFERENCE

FACT SHEET



Water Problem Solved for United States Army Fort Meade, Maryland

U. S. Army Engineer District, Baltimore, Md.
In charge of base construction
Benjamin E. Beavin Company
Consulting Engineers, Baltimore, Md.
Ahlquist Bros. Construction Co., Inc.
Contractors, College Park, Md.
Graver Tank & Mfg. Co., Inc.
Design, Fabrication and Erection

Type: Double Ellipsoidal Elevated Tank
Capacity: 600,000 gallons
Height to Overflow: 111' 6"
Head Range: 38'
Diameter of Tank: 55'
Built to AWWA Specifications
Aircraft warning lights in accordance with CAA
regulations
Sterilized and Cathodic Protected

THE PROBLEM

An office building for the Department of Defense, comparable in size to the Pentagon, was completed last year at Fort George G. Meade, Maryland. The resulting influx of thousands of additional people to this military post called for the construction of 1,000 Capehart Housing Units near the office building. A major requirement for this project was the need to provide ample water for domestic use and for fire protection.

THE SOLUTION

The Corps of Engineers, Baltimore District, and the consulting engineers studied the problem and, based on Corps of Engineers criteria for water supply facilities, found that 600,000 gallons of elevated water storage was indicated for the project to meet the demand for present and future water requirements. In addition, a 50' 3" diameter by 41' 6" high reservoir of carbon steel was erected to supplement the present steel reservoir, with direct pumping facilities to the elevated water tank.

Graver was selected to design, fabricate and erect both the elevated water tank and the reservoir, as well as to provide sterilization, cathodic protection and aircraft warning lights.

The closely integrated cooperation between the Corps of Engineers, Benjamin E. Beavin Company, Ahlquist Bros. and Graver made the solution to the problem an easy one.

It will be to your advantage to discuss your water storage problems with a consulting engineer and Graver, whose mastery in metals is encompassed by a hundred years of experience in tank fabrication and erection.

GRAVER TANK & MFG. CO., INC.

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New York • Philadelphia • Edge Moor, Delaware
Pittsburgh • Atlanta • Detroit • Chicago • Tulsa
Sand Springs, Oklahoma • Houston • New Orleans
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**BUILDING FOR THE FUTURE ON A CENTURY
OF CRAFTSMANSHIP IN STEELS AND ALLOYS**



DESIGNED, FABRICATED AND ERECTED BY



RESERVOIRS erected above ground or underground can be designed to store millions of gallons of water.

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ELEVATED TANKS, from the smallest to the largest, are skillfully fabricated and erected by Graver's craftsmen.

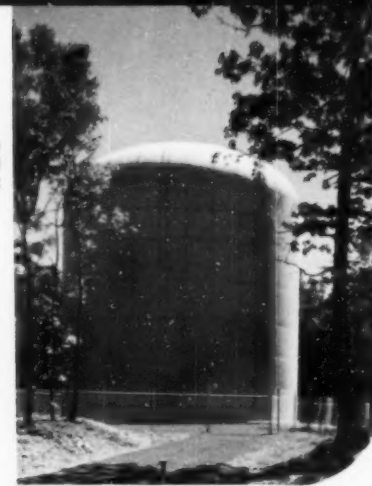


PUMP SUCTION TANKS ranging in size from 100,000 to 300,000 gallons meet full FMFIC specifications.



**Select The Tank That Best
Solves Your Water Storage Needs
...WE MAKE THEM ALL**

GRAVER



STANDPIPES are especially designed to provide the static head required.

A CENTURY OF CRAFTSMANSHIP IN STEELS AND ALLOYS



Clay Pipe for Long-Range Economy

MADISONVILLE, KENTUCKY, is so efficiently managed that for the third successive year no property taxes were levied. With this record for efficiency, it is only natural that corrosion-proof Clay Pipe was chosen for the city's new sewerage expansion program. More than twenty-two and a half miles of Vitrified Clay Pipe are going into the project.

In the opinion of J. Sanders Parker, Consulting Engineer, Clay Pipe is "the best that could be obtained for this service." Clay Pipe never wears out . . . does not rust, rot, or disintegrate . . . is the only pipe backed by a long-term written guarantee. And the new stronger, longer lengths speed installation . . . cut labor costs.

When investigating materials for sewer expansion, remember . . . substitute pipe may have *some* of the features of Clay Pipe, but only Clay Pipe has *all* the features you can trust.

Public Officials: David Parish, Mayor;
A. O. Johnston, Councilman, Chairman of
Water and Sewers.

Consulting Engineers: J. Sanders Parker;
F. E. Stepp, Resident Engineer.

Contractors: C. F. W. Construction Co., Inc.;
Sterrett Construction Co.

Vitrified

CLAY PIPE

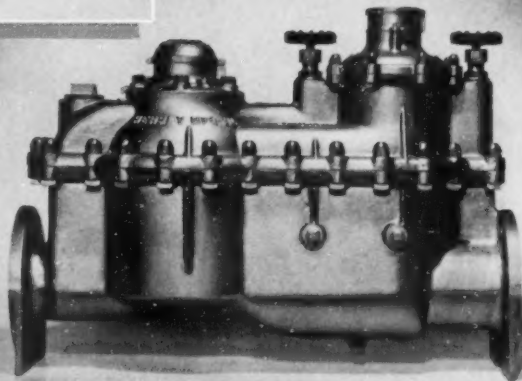
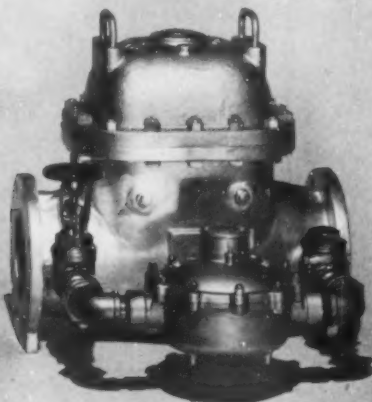
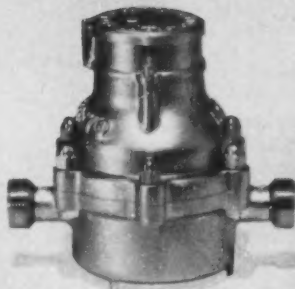
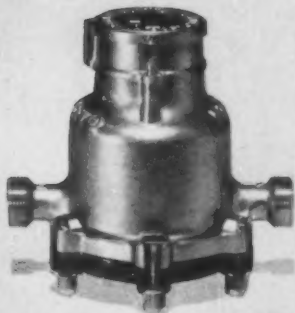
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311 High Long Bldg., 5 E Long St., Columbus 15, Ohio • 783 Ninth & Hill Bldg., Los Angeles 15, California • Box 172, Barrington, Illinois • 206 Mark Bldg., Atlanta 3, Georgia

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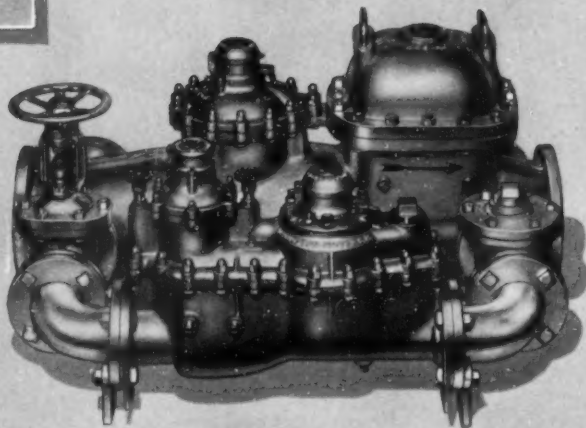
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Your Best Buy For
All Types
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Services



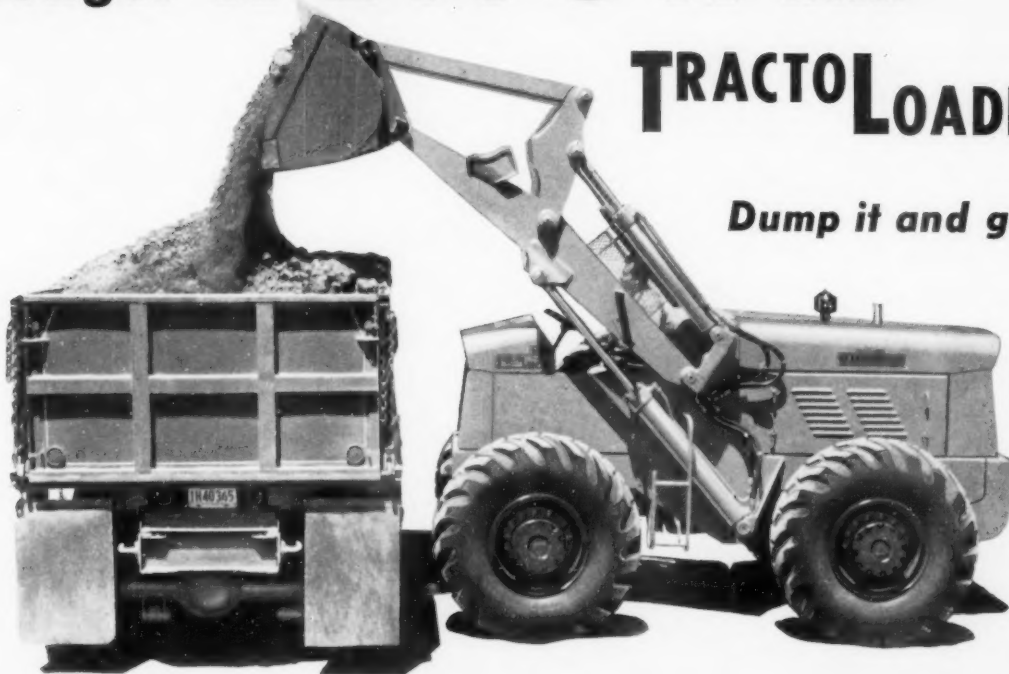
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Longer R·E·A·C·H with TRACTOLOADERS®

Dump it and go...



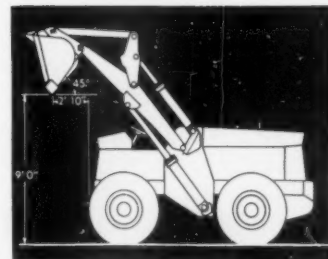
It doesn't matter whether your trucks are seven feet high or nine feet high . . . you load them all faster with the long-reaching TL-20 TRACTOLOADER.

Here this 2-yd loader is dumping right into the center of a 12-ton truck, 8 feet high, 8 feet wide. No wasting time dozing loads with bucket to distribute them evenly. No loading from both sides of truck to get full payloads.

The TL-20 even has enough reach to load gondola and hopper cars! You always have at least 34 inches of usable dumping reach* . . . and with special long booms you can dump to a height of 11 feet, 4 inches, with 39 inches of reach.

Here is another Tractomotive design difference that makes a performance difference — and a profit difference!

Longer-reaching, faster-dumping TRACTOLOADERS are available for both inside and outside use — 2 and 4-wheel drive.



*USABLE DUMPING REACH

is measured from the foremost point of front tires to cutting edge of bucket in dumped position (as illustrated).

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Thirty more miles of concrete pipe were added to Milwaukee's sewer system in 1957, most of it 8' I.D.

In Milwaukee...

the entire residential sewer system is concrete pipe

Concrete pipe was chosen by Milwaukee in 1923 for its new residential sewage collecting system. All submains and mains have been included in this continuing program. Performance record? Not a single failure attributed to the pipe where it has served residential use.

That's because concrete pipe has uniformly high strength right from the start...and because concrete, by its very nature, grows stronger year by year.

Milwaukee chose concrete pipe be-

cause it meets the requirements of uniformity of strength—strength to carry all the loads—durability, availability and low initial cost.

Add maximum hydraulic capacity and long life. Put all these advantages together and it's easy to see why more and more municipalities are finding concrete is the answer to low-cost, trouble-free pipelines. Write for free literature, "Concrete Sewers," distributed only in the U.S. and Canada.

PORTLAND CEMENT ASSOCIATION

Dept. 12-89, 33 West Grand Avenue, Chicago 10, Ill.

A national organization to improve and extend the uses of concrete

**FOR ALL MODERN
PIPELINES**

concrete

FITCHBURG CHIPPER

**"OPERATES 1693 HOURS
without a breakdown
of any kind!"**

WELDON S. CAMPBELL
64 MUNSON STREET
GREENFIELD, MASSACHUSETTS

February 4, 1958

Fitchburg Engineering Corporation
Fitchburg, Mass.
Mr. Perini, Superintendent

Dear Sir:

On March 23, 1955, we purchased one of your Chippers. You may be interested to know that this machine operated a total of 1,693 hours without a breakdown of any kind. Inasmuch as we are paid for running time only we often start up the chipper 20 or more times daily.

We have followed faithfully your instructions in using a hose on the knives each morning, we find that by doing this we can use the knives for five weeks before sharpening. Even then only about 12 thousands are needed to bring them back.

Contractors find your chipper is ideal and saves them much time and dollars in clearing a woodland area before bulldozing begins.

Your Engineering skill and knowhow has resulted in the finest of all Chippers and I have seen them all in operation.

Hauling time is reduced two-thirds, this results in a large saving in gasoline, parts and labor. I would never again be without one.

Respectfully,

Weldon S. Campbell
Weldon S. Campbell
Tree Warden & Mth Supt.
Greenfield, Mass.



"Our Fitchburg Chipper has been inexpensive to maintain and trouble-free in operation, and has meant a great saving to us in time and labor."

—F. A. Canuso & Sons, Inc.
Philadelphia, Pennsylvania



"During about 2,000 operating hours we have suffered neither employee accident due to chipper operation, nor major mechanical failure."

—Northern Tree Company, Inc.
Potosky, Michigan



"The Fitchburg Chipper is well constructed. The machine is trouble-free and easily maintained."

—John Glasgow, Supt. of P. W.
Township of Mahwah, New Jersey

**Fitchburg Wood Chippers are engineered to stand hard use,
to give long service without excessive maintenance costs.**

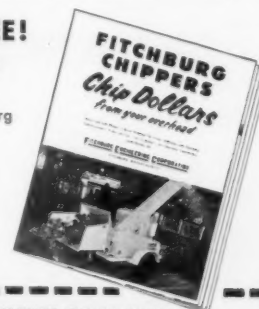
That's the "reason why" successful men like Weldon Campbell prefer Fitchburg for the tough brush removal jobs.

Fitchburg Chippers are designed by engineers for busy, trouble-free service. The exclusive spring-activated feed plate adjusts itself automatically—provides protection from damaging foreign material—assures smooth, efficient operation. The power take-off clutch gives safe starts and stops. There's no fly wheel to cause bearing trouble. These features keep a Fitchburg Chipper on the job... save you time and money.

Read (at right) what others say about their Fitchburg Wood Chippers, and send for your free copy of "Chip Dollars" today.

NEW! FREE! Book of Facts

Detailed cutaway drawings of Fitchburg Chipper in color. Specifications, diagrams, charts, plus money-saving reports and experiences of others.



FITCHBURG ENGINEERING CORPORATION

Fitchburg, Mass., Dept. PW-128

Send Free Copy of "Chip Dollars
from Your Overhead"

Name

Position

Company

City or Town State

FITCHBURG ENGINEERING CORPORATION FITCHBURG, MASS.

seals right ...

Lay Tyton Joint® pipe and relax.

Tyton Joint pipe is sealed tight...water-tight
...by a specially designed rubber gasket that is
compressed by the entering pipe.

Tyton Joint pipe is easy to work with, too. So easy
even "green" crews become experts in minutes.

No bell holes, no pouring snake, no caulking
equipment...no nuts or bolts to



U.S.
cast iron
PIPE

FOR WATER, SEWERAGE AND

bottle tight

tighten. What's more, you can lay Tyton Joint pipe in rain or wet trench if need be. Result? More working days... fewer delays... time and money saved in the trench.

Want more facts about the economical joint engineers have called a most significant advance in cast iron pipe?

Write or call today.

U. S. PIPE AND FOUNDRY COMPANY
General Office: Birmingham 2, Alabama

A WHOLLY INTEGRATED PRODUCER FROM MINES
AND BLAST FURNACES TO FINISHED PIPE

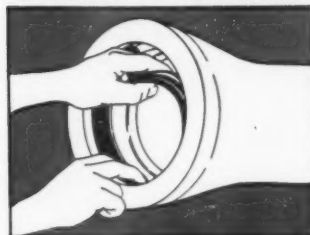


INDUSTRIAL SERVICE

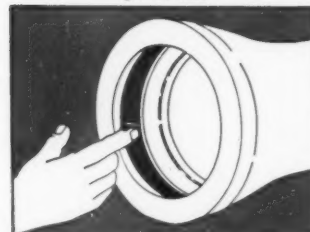
CAST IRON

U. S. TYTON JOINT

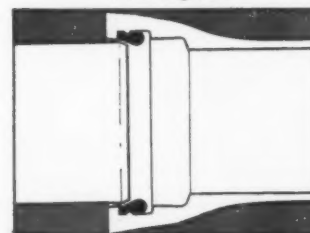
ONLY FOUR SIMPLE ACTIONS



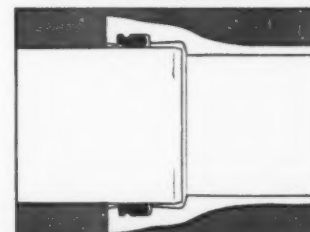
Insert gasket with groove over bead in gasket seat



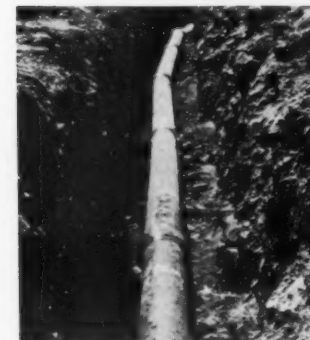
Wipe a film of special lubricant over inside of gasket



Insert plain end of pipe until it contacts gasket



Force plain end to bottom of socket... the job's done!



8" Tyton Joint water line for new high school in Alabama.



1958 STATISTICAL ABSTRACT OF THE U.S.

This abstract is the standard summary of statistics on the social, political and economic organization of the United States. It is designed to fulfill two functions: First, to serve as a convenient volume for statistical reference; and second, to serve as a guide to other statistical publications and sources. This edition, the 79th annual issue, presents data for the most recent year or period available during the early part of 1958. There are over 1200 tables and charts in this 1040-page volume. Copies are \$3.75 each and are available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

ROADSIDE DEVELOPMENT

This is the Report of the Committee on Roadside Development presented at the 37th Annual Meeting of the Highway Research Board. The following papers were given: "Gravel Stabilized Shoulders for Turf as Used on the Natchez Trace Parkway," by Cedric H. Buchanan; "Use of Urea-Formaldehyde Fertilizers When Seeding on Subsoil Highway Slopes," by Edward W. Muller; "Seeding Highway Slopes as Influenced by Lime, Fertilizer and Adaptation of Species," by R. E. Blaser and C. Y. Ward; "Lower-Cost Roadside Maintenance by Spraying," by Lester N. Price; and "Median Design as it Affects Conservation of Vegetation and Planting for Screening Headlight Glare and Traffic Guidance," by Oliver A. Deakin. Copies of Publication 613 are \$2 each and are available from Highway Research Board, 2101 Constitution Ave., Washington 25, D. C.

ANALYSES OF SOIL FOUNDATION STUDIES

The expanded highway program will call for higher, more massive embankments some of which will be constructed over soft foundation soils that present special problems. The five papers presented in Bulletin 173 cover the following:

1) Magnitude and time-rate of settlement due to compression strains; 2) Forces developed in piling due to negative skin friction as consolidation takes place in a soil layer through which a pile penetrates in passing to a firm, less compressible stratum; 3) Four methods used in constructing embankments over marsh deposits. These include the control of rate of placement and use of berms, the removal of soft compressible material, the displacement of weak soil by the embankment, and the installation of vertical sand drains; 4) Review of the use of vertical sand drains over a period when design changed from an empirical approach to one based on theoretical concepts; and 5) Simplified explanation of the theory and related computations for estimating fill subsidence on soft foundations. Copies are \$2 each from Highway Research Board, 2101 Constitution, Washington, D. C.

HIGHWAY RIGHT-OF-WAY PERSONNEL SALARIES

This report was prepared for the Joint Right-of-Way Salary Survey Committee by Edmond L. Kanwit and Paul M. Segal, Transportation Economists; and David R. Levin, all of the Bureau of Public Roads. The salaries cover state highway departments, Federal Government departments, a small number of cities, a few counties and a handful of public utilities. Copies of Publication 604 are available from Highway Research Board, 2101 Constitution Ave., Washington 25, D. C., and are \$2.80 each.

SOLVING URBAN TRANSPORTATION PROBLEMS

The program of the National Committee on Urban Transportation for solving urban transportation problems is contained in this Guide Manual and also the initial series of 15 procedure manuals are available. The Guide Manual is a handbook designed to help representatives of state and county governments in the factual development of over-all transportation plans. The procedure manuals are designed for use by technical or field personnel in carrying out the specific studies recommended in the Guide Manual and in interpreting the data collected. Copies of the Guide Manual are \$5 each and the 15 procedure manuals are \$25 for the set. All may be ordered from Public Administration Service, 1313 East 60th St., Chicago 37, Ill.



ALA. G. C. Phillips Tractor, Birmingham, Prichard
ALASKA The Carrington Co., Seattle, Wash.
ARIZONA Equipment Sales Co., Phoenix
ARK. Clark Equipment Co., Little Rock
Tri-State Eqt. Co., Memphis, (Tenn.)
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HI-WAY Model "E" For Efficient, Year Around Spreading!



MODEL "E"

DUMP BODY MOUNTED

With side or rear mounted engine.

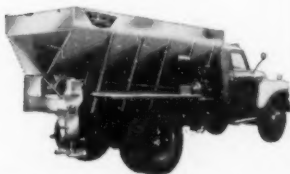
TRUCK MOUNTED
With side mounted engine or PTO drive.



HI-WAY Ice Control Spreaders To Fit Every Specification!



Model Y—Front end spinner, side mounting with oscillating conveyor—lets you see what you're doing.



Model Y2—Reversible body provides front spinner location for ice control—rear corner location for seal-coating.



Model DD—Tailgate mounted spreader for quick ice control treatment and seal-coating.

- *New, Low Center of Gravity • 24" Conveyor Width*
- *Smooth Material Flow • Quick Positive Control*
- *High Angle Sides Prevent Bridging*

- Heavy duty, hi-strength roller type conveyor chain. (Made exclusively by Highway Equipment Company for Hi-Way Spreaders).
- Greater lateral and vertical side bracing.
- Optional and accessory equipment to fit every highway department need.

Highway and street department engineers: Now, before you prepare specifications for new spreader equipment, watch a demonstration* of the Hi-Way Model "E" Spreader. Check the advantages of the wider 24" conveyor width which permits a smoother, even flow of any type of material you will spread. See how a lower spinner height aids traction—gives wider and better controlled coverage at

intersections and in traffic. Find out how this versatile spreader handles seal-coating, dust control and road stabilization jobs without major equipment changes!

Our Business Is S-P-R-E-A-D-I-N-G!

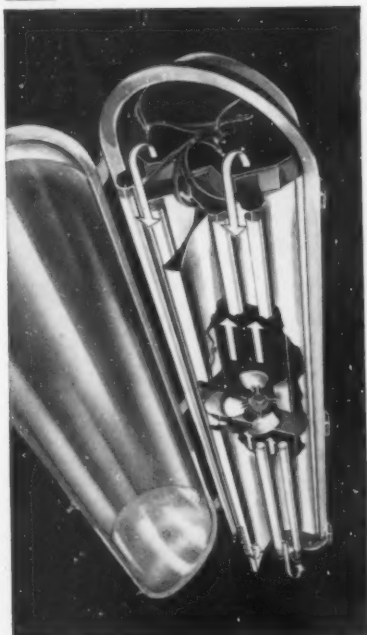
- New Management
- New Distribution
- New Nationwide Service Facilities

*Look on the adjoining page for the distributor nearest you.

HIGHWAY EQUIPMENT COMPANY
607 D. AVE. N. W. CEDAR RAPIDS, IOWA

EXTRA VALUES

1



**FORM 406
FLUORESCENT LUMINAIRE**

INTERNAL FAN COOLING

- Air-circulation system—a G-E exclusive—boosts light output of luminaire up to 25%.
- Four Power Groove lamps generate 37,200 lumens.
- No increase in unit cost.
- Completely factory-assembled and tested; shipped in *single* carton.
- Ideal for business streets, traffic arteries, expressways, interchanges, parking lots, shopping centers.

2

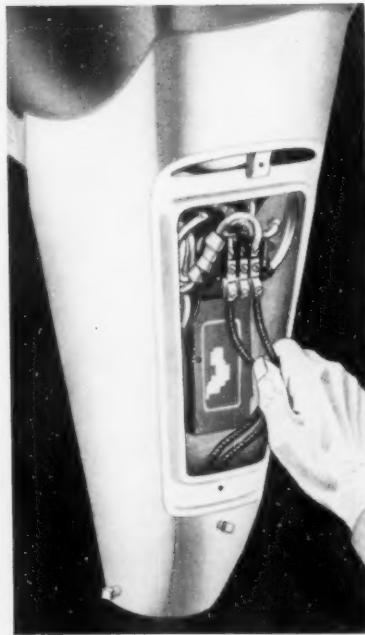


**"TEE-LIGHTING"
FLUORESCENT SYSTEM**

NEW STREET- LIGHTING CONCEPT

- Ideal for "prestige" lighting of business whiteways.
- Highest utilization efficiency of any fluorescent system.
- Greater driver comfort.
- Uni-directional reflectors in parallel units aim light across street.
- Parallel fluorescent units, 18,600 lumens each; transverse unit, 18,600 to 55,800 lumens.

3



**"POWER PACK"
MERCURY LUMINAIRE**

NEW BUILT-IN BALLAST

- Only two terminal connections—saves up to 30 minutes per unit installation.
- Eliminates need for ballast-adapters or transformer-base poles—saves \$30 to \$65 per pole.
- Same outstanding lighting efficiency you have experienced with the General Electric Form 400—best in the industry.
- Low ballast losses.

in Outdoor Lighting from General Electric

4

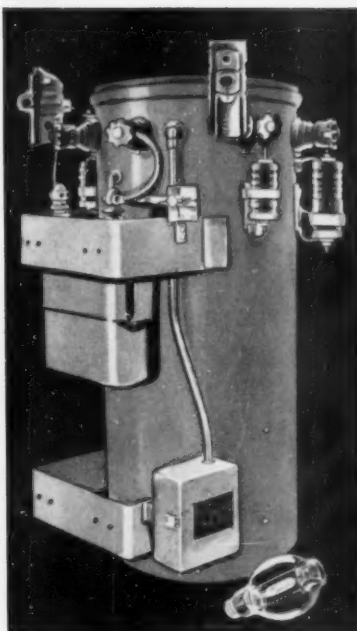


**NEW FORM 400C
MERCURY LUMINAIRE**

ONE-PIECE REFLECTOR HOUSING

- New General Electric one-piece, anodized-aluminum reflector-housing.
- Lighter weight for easy installation and maintenance; larger volume for effective heat dissipation.
- Outstanding versatility; operates five lamps, provides four IES distribution types.
- With precision-molded glass refractor, provides unequalled photometric performance.

5



**FOR 400-WATT
SERIES APPLICATIONS**

BALLASTLESS MERCURY SYSTEM

- New 400-watt mercury lamp with built-in cutout—*exclusive* G-E development gives reliable operation.
- *Packaged* substation-type regulator—another G-E *exclusive*, combines *all* control equipment in self-contained, pre-assembled package.
- Eliminates need for separate ballasts for series circuits.
- Reduces costs of installation, operation, and maintenance.

Check these
EXTRA VALUES
for the complete story
on General Electric's
new Outdoor Lighting
products

- 1 ☐ FORM 406
FLUORESCENT LUMINAIRE
- 2 ☐ "TEE-LIGHTING"
FLUORESCENT SYSTEM
- 3 ☐ FORM 400 "POWER PACK"
MERCURY LUMINAIRE
- 4 ☐ NEW FORM 400C
MERCURY LUMINAIRE
- 5 ☐ BALLASTLESS MERCURY
(SERIES CIRCUIT)

These five advanced-design lighting developments are headliners of more than a dozen new, redesigned products from General Electric. All are outstanding examples of General Electric product and research leadership. Each contains time- and money-saving features which mean EXTRA VALUE for you.

For full details, see your G-E Sales Engineer or Agent, or check the products you're interested in, fill out coupon and mail.

Section B450-4
General Electric Company
Schenectady 5, New York

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Company

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*Progress Is Our
Most Important Product*



**GENERAL
ELECTRIC**



"Transite's installation recent increases

*Says Philip J. Holton, Jr.
Chief Engineer
Water Supply Board
Providence, R.I.*

"Our records show that labor and material costs have increased 100% since 1946. Yet, in this same period of time, our installation costs have increased only 21%. The ease of handling and speed with which contractors can lay Transite Pipe enable us to take full advantage of modern equipment and methods. In this way, Transite has played a prominent part in helping us offset increased costs."



Transite Pressure Pipe helps you cut system costs

3 ways: in design ... installation ... operation!

Today, in every part of the nation, municipal and consulting engineers choose Transite® Pressure Pipe. Ask why, and you find that economy is always among the Transite advantages they consider most important. For no pipe does so much to help keep your costs low in three different areas:

1. Design. Transite lets you plan a system for maximum efficiency. For its high carrying capacity (flow coefficient, C-140) often lets you

specify pipe of smaller diameter. And because Transite's smooth interior remains smooth, you never need to make costly allowances for future reduction in carrying capacity.

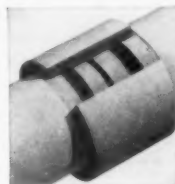
2. Installation. Transite's installation speed cuts time and labor costs substantially. Light in weight for so durable a pipe, it handles easily above and below ground. And its Ring-Tite Coupling assembles quickly, surely . . . giving you a tight seal at every coupling in the system.

savings have helped us absorb
in labor and material costs..."



Crews of Fanning and Doorley Construction Co. installing 8" line in Providence, R. I.

3. Operation. Here's where Transite really saves! For its maintained carrying capacity keeps pumping costs low year after year. Its strength, durability and corrosion resistance cut maintenance to a minimum, provide years of trouble-free service.



Transite's Ring-Tite Coupling cut away to show how rubber rings are compressed and locked in place to form a tight yet flexible joint.

We'll be pleased to send you booklet TR-160A. Write Johns-Manville, PW Box 14, N. Y. 16, N. Y.

**"Good Water, the Lifeblood
of your Community"**
Let's promote it—Let's have it!

JOHNS-MANVILLE
100 YEARS OF QUALITY PRODUCTS . . . 1858-1958



EQUIPMENT and MATERIALS

FOR
YOUR

PUBLIC WORKS PROGRAM

NEW LISTINGS

Information on a Rotary Broom Winder

21. Ben-Ko-Matic automatic broom winder can wind a 6-ft. broom in 8 or 10 minutes and can wind any and all cores. Check the reply card or write Ben-Ko-Matic Mfg. Co., 8028 N. Jersey St., Portland 3, Ore.

Highway Program for Automatic Computation

26. HYPAC makes in one operation all computations for a divided highway and 2 service roads or a diamond interchange, with as many as four independent alignments, none of which need be parallel in either the horizontal or vertical plane. For literature on this computing service write Highway Computing Service, E-505, First National Bank Bldg., St. Paul 1, Minn., or check the reply card.

Engineering Data on Aluminum Grating



30. Engineering data on aluminum grating, safe load tables for pressure-locked aluminum grating and safe load tables for riveted aluminum grating are covered in literature from Kerrigan Iron Works, Inc., Nashville, Tenn. Check the reply card for details on this lightweight, spark proof and non-corrosive grating.

Highway and Bridge Guard Rail

35. Standard drawings on deep beam type guard rail, bridge guard rail data and curving data on guard rail are covered in Catalog No. G-571 from Granco Steel Products Co., St. Louis, Mo. Check the reply card.

Catalog on Complete Line of Black Top Equipment

46. Portable asphalt plant, pressure distributors, bituminous mixers, brooms, heater-planer, kettles, rollers, storage tanks and surface heaters are some of the equipment covered in Catalog JJ-1 available from Littleford Bros., Inc., 453 E. Pearl St., Cincinnati 2, Ohio. Check the reply card.

Foundation Investigation and Pressure Grouting

48. Foundation investigation and pressure grouting and the various miscellaneous services of Sprague & Henwood are described and illustrated in literature from Sprague & Henwood, Inc., Scranton 2, Pa. Check the reply card.

How Eleven Cities Installed Water Meters

56. This 8-page bulletin describes the planning and operational procedures used by 11 water departments and companies in the installation of about 200,000 water meters. Check the reply card or write The Ford Meter Box Company, Inc., Wabash, Ind., for methods of installation and rate cards.

The engineering information in these helpful catalogs will aid you in your Engineering and Public Works programs. Just circle numbers you want on the reply card, sign and mail. This free Readers' Service is restricted to those actively engaged in the public works field of cities, counties or states.

Stabilene Film for Drafting, Scribing and Reproduction

60. Stabilene film insures accuracy of drawing and reproduction and will last indefinitely. It comes in rolls, sheets or special sizes to order and lies flat or can be curved or rolled. Check the reply card or write Keuffel & Esser Co., Adams and Third Streets, Hoboken, N. J., for complete catalog.

Catalog on Synchronous Motors and Controls

64. A 27-page Catalog B-7292 on synchronous motors and controls is well illustrated and contains motor selector charts, application data, and formulas for calculating power factor. For a copy write Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa., or check the reply card.

MORE LISTINGS ON PAGES 36 TO 56

Handbook Explains Water Conditioning With Ion Exchangers

66. The 60-page handbook from National Aluminate Corp., Ion Exchange Div., 6198 West 66th Place, Chicago 38, Ill., discusses softening, dealkalizing and demineralizing processes from the standpoint of equipment and chemicals required and quality of water produced. Check the reply card.

Fischer & Porter Quick Shipment Catalog and Price List

72. A 52-page catalog on process instruments which covers indicators, transmitters, recorders and controllers for flow, pressure, temperature, density, viscosity and consistency is available from Fischer & Porter Co., 941 Jacksonville Road, Hatboro, Pa., or by checking the reply card.

Submersible Electric Pumps

74. Portable, fully submersible electric pumps for construction and maintenance work are described in literature from Stenberg Mfg. Corp., Hoosick Falls, N. Y. Check the reply card for capacities, weights and horsepowers.

Rotary Sweeper Broom Cores and Drag Brooms

78. Broom cores and drag brooms are covered in literature from Dallas Brush Mfg. Co., 2054 Irving Blvd., Dallas 7, Tex. Check the reply card for types, sizes and cost.

Road Rollers and Compaction Equipment

73. An illustrated 12-page Bulletin No. S-74-858 covering its entire and expanded line of road rollers and compaction equipment is available from Buffalo-Springfield Roller Co., Div. of Koehring Co., Springfield, Ohio. Check the reply card today.

Dickey PVC Couplings for Vitrified Clay Pipe

92. Dickey PVC couplings are easy to install and bond tightly and permanently to the surface of the pipe for long life, water tightness and root-resistance. Check the reply card or write W. S. Dickey Clay Mfg. Co., Kansas City 6, Mo., for full details.

Liner Plates for Support of Excavations in Tunnels and Shafts

102. Properties and general specifications of liner plates are covered in catalog from Commercial Shearing & Stamping Co., 1775 Logan Ave., Youngstown 1, Ohio. Check the reply card for data and dimensions, safe load values, and required thickness of liner plates.

Handbook on Salt for Ice and Snow Removal

103. The data in this handbook is a survey made by the Salt Institute on the use of salt as a deicing agent. Salt's deicing properties are explained and supported by technical tables. Check the reply card or write the Salt Institute, 333 North La Salle St., Chicago 2, Ill.

Simplified Rate-of-Flow Controller for Filters

106. The "Modulair" is a self-contained unit which may be inserted in a rapid sand filter effluent line for rate-of-flow control. Its application and compact, simplified construction are described and illustrated in color in Bulletin 951. Write Simplex Valve and Meter Co., Lancaster, Pa., or check the reply card.

Construction Pumps that Never Let You Down

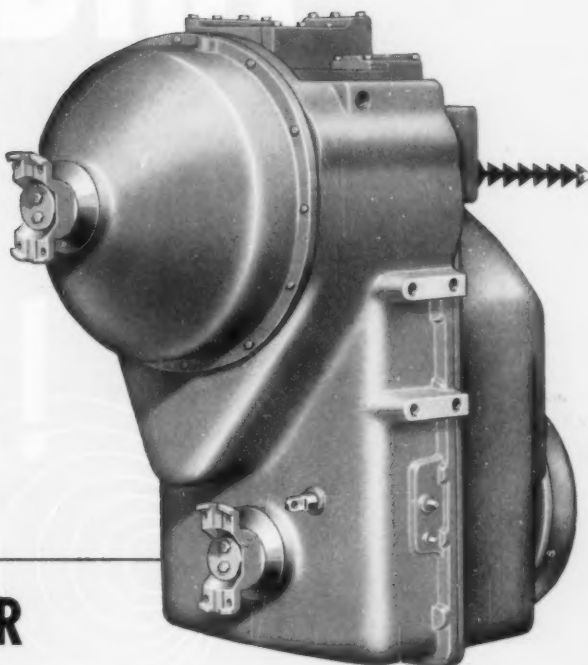
108. Self-priming centrifugal high head, closed diaphragm and electric motor-driven pumps are covered in 20-page catalog from Chain Belt Co., Milwaukee 1, Wis. Check the reply card for table of water friction and how to choose the right pumps.



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For Prompt Service

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addition
to**

**HYDRA-
DRIVES
LINE!**



**FULL-POWER
SHIFT
TRANSMISSIONS** now available for
equipment of from 60 to 175 h.p.

Rockwell-Standard's new model Hydra-Drives Full Power Shift Transmission is now available in sizes especially designed for smaller installations, such as front end loaders, fork trucks, scrapers, crane carriers, rubber tire tractors and military vehicles. A single compact package combining torque converter and 4-speed, all power shift transmission, the Type BDB Transmission puts power to work smoothly, efficiently and economically.



**Only the Hydra-Drives BDB
offers all these major advantages:**

4 Speeds Forward and Reverse. All Power Shifted! Provides for maximum horse power to load under all load conditions.

Easier Servicing and Maintenance. Fewer moving parts and bearings. Simple, rugged countershaft design and spur gears simplify maintenance.

Full Disconnect provides for split drives and makes it easier and safer to tow.

Dual Reduced Speed Pump Drives can be driven at engine speed or $\frac{1}{2}$ engine speed for longer pump life and increased horse power to load.

Integral Design. Torque converter, transmission, oil passages, valving and oil sump are in one compact housing. Package is less bulky... up to $7\frac{3}{4}$ inches shorter than comparable models. Provides easier installation and less maintenance.

To order these helpful booklets check the reply card opposite page 40.

NEW LISTINGS (Cont.)

Four Wheel Drive 1 1/4 yd. Front End Loader

115. The Trojan 1 1/4 yd. loader for heavy-duty bulk materials handling is covered in bulletin available from Contractors Machinery Div., The Yale & Towne Mfg. Co., Batavia, N. Y. Check the reply card.

Heavy-Duty, Non-Volatile Brush and Vegetation Killer

116. Quick acting, complete kill and no drifting Fence Fire kills all brush and weeds with one gallon making up to 100 gallons of spray. Write The Gledhill Road Machinery Co., Galion, Ohio, or check the reply card for complete literature.

Handbook for Engineers on Design and Construction of Culverts

121. Metal pipe specifications, highway, municipal and airport drainage facts, selecting a drainage structure, designing waterway area, designing for structural strength and headwalls and inlets are sections covered in this handbook. Check the reply card or write Republic Steel Corp., Culvert Div., 2318 — 13th St., N.E., Canton 5, Ohio.

Plywood Signs For Expressway Signaling

149. Crezon overlaid plywood signs will withstand the worst weather and will not check, split or bend or tear loose from the pole. Check the reply card or write Crown Zellerbach, San Francisco 19, Calif., for complete data on this signaling material.

Data on Leach Packmaster Refuse Compaction Unit

130. Details on sizes of this compaction unit that range from 10 to 25 cu. yd. capacity and a description of its fast, safe, simplified loading are covered in literature from The Elgin Corp., Sanitation Headquarters, 231 South La Salle St., Chicago 4, Ill. Check the reply card.

Sealed Electrode Floatless Pump Controller

99. The floatless pump controller is a valuable accessory for sewage and drainage sump pumps for it is never affected by corrosive elements, has no moving parts and cannot become coated with grease, oil or soap. For design data and specifications write Food Machinery and Chemical Corp., Chicago Pump Co., 622 Diversey Parkway, Chicago 14, Ill., or check the reply card.

Buffalo Turbine Sprayers for Fly and Mosquito Control

132. Specifications and data on the Buffalo Turbine that permits spraying of larviciding liquids and dusting for adult control are covered in literature from Buffalo Turbine Agricultural Equipment Co., Inc., Gowanda, N. Y. Check the reply card.

Make Blueprint Filing Easier and More Efficient

136. A blueprint rack for engineering departments that is made of steel and is equipped with 12 plan holders is described in literature available from Momar Industries, 4323 West 32nd St., Chicago 23, Ill. Check the reply card for price list and the advantages of this easy to move and complete unit.

Blower Selection Data Aids Sewage Plant Design

144. Characteristic curves for blower operation with constant-speed, multi-speed and variable speed motors; details of several types of blowers; data on accessories; and a discussion of advantages of positive displacement rotary blowers are provided in Bulletin RB 154 of Roots-Connorsville Blower Div., Connorsville, Ind.

Capacity, Weight and Power You Want in a Compressor

148. Bulletin 2307 available from Ingersoll-Rand, 11 Broadway, New York 4, N. Y., gives complete specifications on the Ingersoll-Rand 85 cfm rotary compressor. Check the reply card for data on this ideal air power plant for hundreds of municipal maintenance jobs.

Case Rubber-Tired Backhoe-Loader

128. Data and specifications on the Case rubber-tired backhoe-loader and tractor are available from J. I. Case Co., Racine, Wis. Check the reply card.

Reduce Your Refuse Disposal Costs

150. A complete line of refuse disposal systems that include containers, giant containers, compaction bodies and compaction trailers are described in literature from Demster Brothers, Dept. PW, Knoxville 17, Tenn. Check the reply card for data on these efficient systems.

Rugged Axles Save Money For Truck Owners

151. Eaton axles feature planetary gearing, self-contained air brake, positive shift control, induction alloy axle shafts and forced-flow lubrication. Check the reply card or write Axle Div., Eaton Mfg. Co., Cleveland, Ohio, for complete catalog.

AWWA Fire Hydrants and Gate Valves

155. Above-ground maintenance Mueller AWWA improved fire hydrants and minimum maintenance Mueller AWWA non-rising stem gate valves are described in literature from Mueller Co., Decatur, Ill.

Chip Dollars from Your Overhead With Fitchburg Chippers

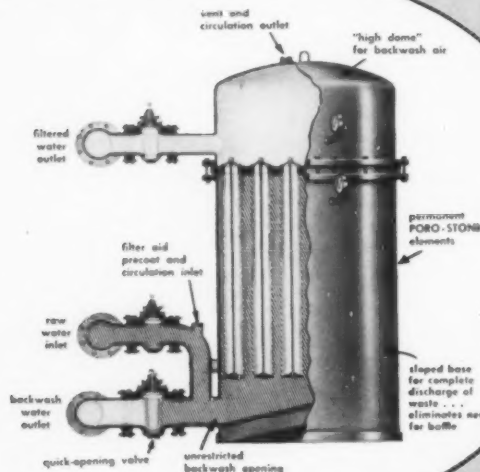
160. Detailed cutaway drawings, specifications, diagrams, charts and money-saving reports and experiences are covered in catalog available from Fitchburg Engineering Corp., Dept. PW, Fitchburg, Mass.

Ford Tractors Equipped With Loader of 2500 lb. Lift

162. New Ford tractors give you multi-job versatility with a full line of attachments. Check the reply card or write Tractor and Implement Div., Ford Motor Co., Birmingham, Mich., for data on this rugged and powerful tractor.

(More listings on page 42)

Adams NEW IWF FILTER Can Help You Solve Your Municipal Water Problems!



Is your budget short of funds for needed filter area? Would you like to add to your present filter capacity for peak loads without constructing new filter housing?

The R. P. Adams IWF filter is an ideal answer to each of these problems.

First, you can add a maximum of filter area at a minimum cost with the IWF. Other filters may cost less initially, but up-keep, labor and replacement parts will rapidly offset any such advantage.

Operating on standby condition, the IWF can be quickly placed on-stream for peak loads. It is simple and fast to clean... no disassembly necessary... after your peak demands have been met.

Waste space in your sand filter housing probably will accommodate the IWF... eliminating the need for costly new construction.

Write for your copy of Bulletin 651 for full details. If your city is planning a public swimming pool, you'll want to ask for Bulletin 626 as well.

Adams IWF Filters come in six basic sizes from 53 to 238 square feet of area... in multiple unit plants from 106 to more than 1000 square feet of filter area. Normally delivery can be made from stock on hand.

R. P. Adams Co., Inc.

228 East Park Drive, Buffalo 17, New York

BUYING A TRACTOR-LOADER?

Insist on honest answers to these basic questions...

1 HOW MUCH WORK CAN IT DO?

The all new Ford outlifts, outperforms any rig in its class!

2500 lb. lift — $\frac{1}{4}$, $\frac{3}{4}$ and 1 cu. yd. tread width buckets among many attachments. **5500 lb. breakaway** — Unmatched pry-out capacity... no stalling in banks or frozen piles. **22° bucket roll-back**... Less spillage in transport... carry bucket low for greater stability. **5" flat-bucket, below grade digging** — "Float" valve relieves down pressure when desired for grading, leveling. **24" reach at 8' 5" dump height** — Big clearance over any standard truck side... load entirely from one side. **"Red Tiger" engine** — Biggest, most powerful ever made by Ford... choice of gasoline or diesel.

2 HOW STRONG IS IT BUILT?

The all new Ford is a glutton for punishment!

Heavy duty tractor — 7,000 lb. rated capacity front axle assembly... cast malleable combination grille and bumper... full length load-carrier frame. **Super-Duty Loader** — Rigid diagonal bracing eliminates bucket sway... tapered box section lift arms of lighter, stronger steel alloy to reduce dead weight... large, replaceable, heat treated pivot pins and bushings... all cylinder rods heat treated and chrome plated for long wear... most hydraulic lines internal, protected.

3 HOW DOES IT HANDLE?

The all new Ford provides easy, effortless operation!

Exclusive full hydraulic steering — Separate hydraulic system gives instant response, takes less than one turn of wheel to full left or right... cable controlled steering valve eliminates kickback... no mechanical parts to maintain. **Special steering wheel** — Slip clutch permits steering from any position, easily changed for stand-up driving... out of way in mounting tractor, shifting gears and using loader controls. **Foot throttle** — Pre-select operating speed with hand throttle, use overriding foot throttle to speed loading cycle... frees one hand for loader controls. **Shuttle shifting** — Simple reversing transmission is factory-installed option for quick back-and-forth shifting. **Superior visibility** — No steering rods, radius rods, etc., to obstruct vision along sides... diagonal loader braces eliminate cross bracing, permit dramatically low design with no part of rig extending above top of steering wheel.

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LIFTS 2500



ALL NEW FORD INDUSTRIAL



2500 LBS!

**THE HEART OF ANY
TRACTOR-LOADER
IS ITS
HYDRAULIC SYSTEM**

**And there's nothing
on the market
to match the new Ford!**

Exclusive "Universal" system — oil reservoir, pump, heat exchanger, and valve required for loader, backhoes, other attachments — is an integral protected part of the tractor . . . exclusive features include forced air heat exchanger to keep oil cool, micronic filtering, sealed, tern-plated sump to keep oil clean, and positive circulation to eliminate efficiency robbing cavitation. **Stack type control valves** — Give up pressure, down pressure and "float" position . . . positive valve feathering for instant, controlled response . . . safety and relief valves cushion tractor-loader from shock loads . . . extra attachments easily added . . . All of this is in addition to Ford's Hydraulic System for control of rear-mounted attachments and Ford's completely hydraulic steering system.

Design, materials and/or specifications are subject to change without notice and without liability therefor.

L NEW!
TRIAL TRACTOR-LOADER

**YOU SEE MORE
FORDS
BECAUSE THEY SAVE
MORE MONEY!**

**See back page for
still more features . . .**

YOU SEE MORE

FORD

BECAUSE

THEY SAVE MORE

AN IMPORTANT ANNOUNCEMENT FROM FORD!



NOW! ...climaxing 30 years' leadership in the industrial tractor field, FORD introduces:

NEW A rugged and powerful tractor designed solely for industrial work!

NEW A Super-Duty Loader with 2½ times as much lift capacity as ever before in Ford history!

NEW And due at your dealer's soon, an exclusive line of 10', 12' and 14' Ford backhoes!

All retain Ford's traditional economy and versatility, yet offer unmatched performance and rugged stamina never before engineered into any equipment short of specialized and expensive "heavy machinery."

... get the "inside" story!

Che

New
power

46.5 b
models
diesel

New
with

Short
excellent
3800 lb
capacity
add 12
lbs.; ri

New
tires

Standard
type v
choice
cleat

SEE MORE FORDS

CAUSE MORE MONEY!



Check your job needs against these
**ALL NEW
FORD FEATURES**

New Ford gives you mud-slogging, flat-torque power!

46.5 belt H.P. and 42.1 drawbar H.P. in gasoline models; 41.5 belt H.P. and 37.75 drawbar H.P. in diesel models (Manufacturer's rating).

New Ford combines plenty of work weight with "turn-on-a-dime" mobility!

Short wheelbase with low center of gravity gives excellent stability. Basic shipping weight of approx. 3800 lbs. can be increased to full weight-bearing capacity of rear tires (28" cast iron wheel discs, optional, add 1200 lbs. to rear wheels; tire fill adds up to 900 lbs.; ring-type wheel weights can be added as desired).

New Ford offers wide choice of wheels and tires!

Standard 7.50 x 16 8-ply front tires are on steel disc type wheels with 5.50 x 16" rims. Rear tires offer choice of 12 x 28 (standard), 13 x 24, or 14 x 24 with cleat or button tread.

New Ford saves time, reduces waste motion!

Convenient instrument and control cluster includes Proof-Meter, standard on all models. Bucket position indicator takes the guesswork out of bucket spotting . . . speeds up loading cycle.

New Ford cuts fatigue, spurs production!

Comfortably upholstered seat with back rest and optional all-weather cab give your operator a break, as does the wide-open, step-on mounting to tractor seat. Models 1841 and 1841-D are equipped with Ford's 3-point linkage and hydraulic system for effortless instant control of rear-mounted attachments.

New Ford offers full line of attachments!

Heavy, medium and light material buckets — all tread width with long, tapered cutting edges and curved backs for easy, efficient bucket filling. Also material fork, dozer blade, crane, and rear counterweight box for front or rear use. Quick 4-pin changing.

New Ford gives you multi-job versatility!

Ford's new line of matched and integral industrial tractors and equipment will include 10', 12' and 14' backhoes and heavy duty dozer and rear blades . . . all due at your dealer's soon — and more on the way!

- 1 New Ford Super-Duty Industrial Loader series 712
- 2 New Ford Industrial Tractor series 1801
- 3 New Ford 10', 12', 14' Backhoe line coming soon! series 713.

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... and often lots more helpful!

We all treasure our textbooks, but it's smart business to have the very latest product information on hand whenever a new purchase or another engineering project is contemplated. Manufacturers' literature is revised frequently, so you can check the current specifications on all types of products. Our Readers' Service Department will help you get up-to-the-minute data on equipment, materials and services.

COLLECT NEW DATA See pages 34 to 56 and 175 to 180
IN A HURRY for a quick review of new products and valuable literature. To get the data you need, circle the corresponding numbers on the tear-out card on this page, print your name, title and address, and drop in the mail. All requests are handled promptly.



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12-58

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Washington, D. C., Jan. 5-9, 1959

American Road Builders' Assn.
Dallas, Tex., Jan. 19-22, 1959

New York Section, FSIWA
New York, N. Y., Jan. 22-23, 1959

Associated Equipment Distributors
Chicago, Ill., Jan. 25-29, 1959

New York Section, AWWA
New York City, N. Y., Jan. 27, 1959

National Bituminous Concrete Assn.
Miami Beach, Fla., Feb. 2-6, 1959

Indiana Section, AWWA
Indianapolis, Ind., Feb. 4-6, 1959

Mississippi Section, FSIWA
Jackson, Miss., Mar. 6, 1959

Texas Water and Sewage Works Assn.
Short School at Texas A & M College
College Station, Tex., Mar. 1-6, 1959

New Jersey Section, FSIWA
Atlantic City, N. J., Mar. 11-13, 1959

Illinois Section, AWWA
Chicago, Ill., Mar. 11-13, 1959

Louisiana Section, FSIWA
Baton Rouge, La., Mar. 18-20, 1959

New England Section, AWWA
Boston, Mass., Mar. 19, 1959

Southeastern Section, AWWA
Columbia, S. C., Apr. 5-8, 1959

5th Nuclear Congress including:
Nuclear Engineering & Science
Atomic Energy Management
Hot Laboratories & Equipment
Atomfair
Cleveland, Ohio, Apr. 5-10, 1959

Montana Sections AWWA and FSIWA
Glendive, Mont., Apr. 9-11, 1959

Nebraska Section, AWWA
Lincoln, Nebr., Apr. 15-17

Arizona Sections, AWWA and FSIWA
Phoenix, Ariz., Apr. 16-18, 1959

Kansas Section, AWWA and FSIWA
Hutchinson, Kans., Apr. 22-24, 1959

Pacific Northwest Section, AWWA
Vancouver, B. C., Apr. 23-25, 1959

California Section, FSIWA
Long Beach, Calif.,
Apr. 29-May 2, 1959

Southern Branch, American Public Health Assn.
Miami, Fla., May 27-29, 1959

Central States Section, FSIWA
Minneapolis, Minn., June 24-26, 1959

**American Water Works Assn.
California Section, AWWA**
San Francisco, Cal., July 12-17, 1959

Rocky Mountain Section, FSIWA
Jackson, Wyo., Sept. 7-9, 1959

American Public Works Assn.
Seattle, Wash., Sept. 20-23, 1959

Federation of Sewage & Industrial Wastes Assns.
Dallas, Tex., Oct. 11-15, 1959

12-58

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**NORTH CAROLINA'S NEW
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"Cuts maintenance to the bone"



AND IT'S TASSCO FOR SIGNS

The signs, provided by Traffic & Street Sign Company, are the new Increment Sheet Signs. The faces are in strict accordance with the Federal Interstate Highway Signing Manual. In this way, P & K and Tassco, associated companies, provide a unified responsibility for the entire program.

This is North Carolina's new Interstate Highway Route 40. Since, under the terms of the construction program, North Carolina is to maintain the road, the State specified those materials which would keep such costs at an absolute minimum. Their choice was Pfaff & Kendall's all aluminum sign spans and Traffic & Street Sign Company's increment sheet signs with tapered aluminum supports. Thus, with 9 large sign spans, 1193 signs, and 501 sign supports, not one drop of paint is required for maintenance!

Take the sign span in the photo for example, 90 feet wide, it bears nearly 500 square feet of sign, and without a center support. Yet it provides all the strength demanded—enough to withstand 100 mph winds—yet light enough in weight to have made installation unbelievably easy. As a matter of fact, it took only eight minutes to erect the 90-foot truss section! As for maintenance, there is none. The good-looking aluminum span never needs painting, not at installation or at any other time.

For any signing program, there's a wealth of helpful data available through the Tassco-P & K Highway Planning Committee, including a full color movie of the North Carolina program. This service, as well as the planning assistance of the Committee is available without charge to all State Highway Depts. Address your requests to "Committee."

P&K

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To order these helpful booklets check the reply card opposite page 40.

WATER WORKS

Handbook of Cast Iron Pipes and Fittings

52. Full engineering data on products of the Alabama Pipe Co., including Super De-Lavaud cast iron pressure pipe and pipe fittings, valve boxes and other municipal castings are provided in Pressure Pipe Catalog No. 54, a 196-page publication of Alabama Pipe Co., Anniston, Ala. Weights, dimensions and specifications are clearly indicated in this easy to use in reference.

Efficient Coagulation With Ferri-Floc

69. Advantages claimed for Ferri-Floc as a coagulant include wide pH range, quick floc formation, manganese removal control of certain tastes and odors plus other aids in high quality water production. Check reply card for complete Ferri-Floc data. Tennessee Corp., Grant Bldg., Atlanta, Ga.

Convenient Reference Manual Covers Cast Iron Pipe, Valves and Hydrants

76. An 80-page manual, issued by R. D. Wood Co. Independence Sq., Philadelphia 5, Pa., presents specifications for "Sand-Spun" cast iron pipe and fittings, outlines types of joints available, lists dimensions and weights in convenient tables and includes, in addition, full engineering data on the Mathews fire hydrant and R. D. Wood gate valves.

Engineering Data on Diatomite Filters

139. Get complete data on the Sparkler model RJ-Pressure or HCV-Vacuum Type diatomite slurry feed filter for swimming pools or Municipal Water Works from the Sparkler Mfg. Co., Mundelein, Ill. Check the reply card for full information including table of filter sizes and capacities, space required and filter operation.

Elevated Tanks and Other Storage Facilities

32. Specification sheet covering elevated tank sizes and design and illustrated brochure available from the Darby Corp., Kansas City 15, Kansas.

Rapid Sand and Pressure Filter Data

109. Rapid sand filters. A complete line of vertical and horizontal pressure filters, wooden gravity filters, and filter tables and other equipment. For engineering data, write Roberts Filter Manufacturing Co., 640 Columbia Ave., Darby, Pa., or check the reply card.

Valve and Hydrant Construction Details

161. A 72-page catalog-type bulletin, just completed, gives detailed data on construction and application of gate valves, check valves and hydrants for water works service. Write for Bulletin 5710 from Darling Valve and Mfg. Co., Williamsport, Pa., or check the reply card.

Design of Prestressed Concrete Tanks

194. An 8-page technical Bulletin, T-19, on the Design of Prestressed Concrete Tanks, gives engineering data and formulas of general interest to anyone considering prestressed concrete for storage tanks. Check the reply card or write The Preload Co., Inc., 21 East 37th St., New York 16, N. Y.

Complete Catalog and Reference Data on Valves and Fittings

211. The entire M & H line of valves, fittings and accessories for water works, filtration, sewage disposal and fire protection are illustrated and fully detailed in Catalog 52 issued by M & H Valve & Fittings Co., Anniston, Ala. In addition to complete data on these products, there are many pages devoted to helpful engineering data. Every designer should have a copy.

Trenching Equipment Data Conveniently Assembled

212. The entire line of Cleveland trenching and backfilling equipment is now covered in a single bulletin, with material arranged for quick comparison of capacities, specifications and dimensions of all models. Twenty-four action photos graphically illustrate various job applications. Get Bulletin S-120 now for easy review of your trenching equipment needs. Just check the reply card or write to the Cleveland Trencher Co., 20100 St. Clair Ave., Cleveland 17, Ohio.

Manual on Pipe Finding Techniques

213. A manual on special pipe finding and leak detecting techniques of interest to utilities, municipalities, oil and gas companies is announced by Fisher Research Laboratory, Inc., 1961 University Ave., Palo Alto, Calif. The manual contains a number of articles on locating buried pipes and cables and detecting and locating fluid leaks in pipe lines.

Use The Reply Card

Outline of Modern

Water Treatment Equipment

248. Bulletin 4433 is recommended for engineers who need a basic refresher course on treatment of municipal and industrial water. It lists water impurities and methods of treatment and illustrates treatment systems and equipment. Check the reply card or write The Permutit Co., a Division of Pfau-Pfau-Permutit Inc., 50 West 44th St., New York 36, N. Y., for your copy.

Chapman

Standard Sluice Gates

276. Manual, hydraulic or electric motor control sluice gates are described fully in Catalog 25 available from The Chapman Valve Mfg. Co., Indian Orchard, Mass. These valves are easy to replace and are fitted without alterations. Check the reply card.

New manganese steel tines cut grapple maintenance UP TO 25%!

The new Blaw-Knox TI-150 (1½ cubic yard) and TI-250 (2½ cubic yard) incinerator grapples are designed to slash tine maintenance costs, and losses due to failure of retaining arrangements.

Equipped with Hadfield 12-14 per cent Manganese steel tines, these new grapples give added resistance to abrasiveness. In addition, the tines are designed to resist breakage experienced in incinerator operation.

A new retaining arrangement features a completely enclosed top key, and the bottom key placement gives added protection against blows. All tines are held in such way as to prevent accidental shearing.

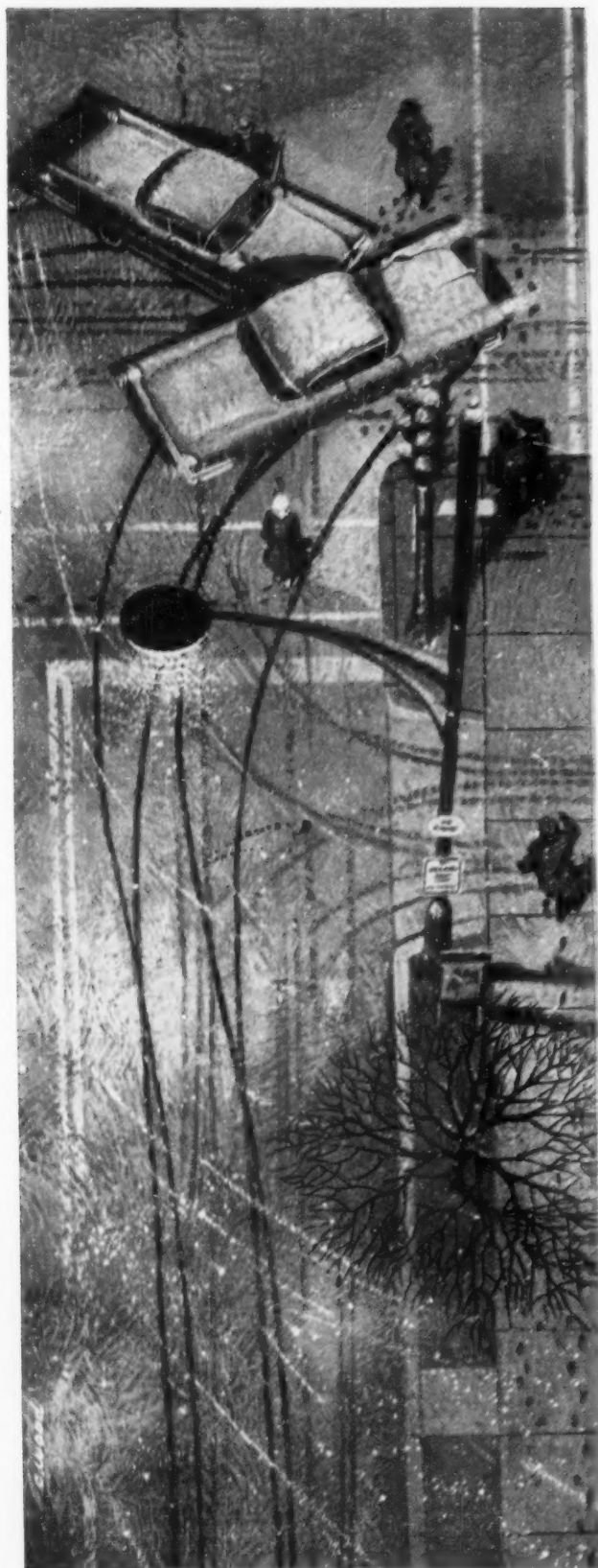
Get full details and other helpful information which will improve your operation from your Blaw-Knox Bucket engineer.

New TI-250 (2½ cubic yard) grapple equipped with manganese steel tines in daily service.

BLAW-KNOX COMPANY

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Pittsburgh 38, Pennsylvania





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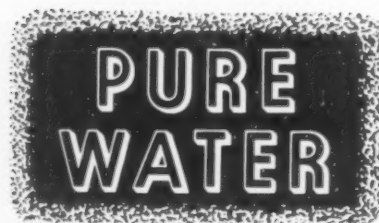
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To order these helpful booklets check the reply card opposite page 40.

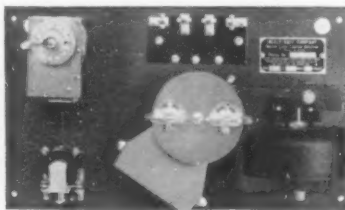


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Write for New Bulletin RPS

WATER LEVEL CONTROLS DIVISION

HEALY-RUFF Company

791 Hampden Ave., St. Paul 4, Minn.

Clow Bell-Tite Cast Iron Pipe

280. Laying water mains is easier, faster and more economical with Clow Bell-Tite joint cast iron pipe. Joint employs a single rubber gasket as the only accessory. Complete details available in illustrated literature from James B. Clow & Sons, Inc., P. O. Box 6600-A, Chicago 80, Ill., or check the reply card.

Factors to Consider in Elevated Tank Selection

299. Details on the several different types of elevated steel tanks, including capacity ranges, tank dimensions and other factors to be considered in the selection of elevated tanks for modern water storage, plus discussions of new tanks for old towers and foundations are included in Bulletin 101 of the Pittsburgh-Des Moines Steel Co., Neville Island, Pittsburgh, Pa. Check reply card for your copy.

Manual on the Hersey Disc Water Meter

329. Illustrations, descriptions and specifications of Hersey water meters are covered in manual available from Hersey Mfg. Co., 250 Elm St., Dedham, Mass. Size ranges are $\frac{3}{8}$ "- $\frac{5}{8}$ "x $\frac{3}{4}$ "- $\frac{1}{2}$ " and 1". Check the reply card.

Points to Consider in Filter Sand Selection

332. Best operation of rapid sand filters requires filter media which is hard, properly shaped, carefully graded and perfectly clean. Filter sand and gravel which meets these exacting requirements is available on short notice from Northern Gravel Company, Box 307, Muscatine, Iowa.

Tips for Installing Orangeburg Pipe

336. Good practice for installation of Orangeburg pipe and fittings is outlined in an illustrated four-page bulletin made available by the Orangeburg Mfg. Co., Inc., 375 Park Avenue, New York 22, N. Y. Trenching and backfilling, pipe laying, cutting and connecting with other types of pipe are included. Use the reply card for your request.

Engineering Data on Equipment for Municipal Water Conditioning

347. For information on the design and operation of many types of water treatment plant equipment, including the Graver Reactivator, pressure filters, iron removal installations, zeolite softening and water conditioning for swimming pools get Bulletin WC-113 from Graver Water Conditioning Co., 216 West 14th St., New York 11, N. Y. Check the reply card.

Automatic Bin Level Indicators For All Bulk Materials

378. Bin level indicators for municipal water treatment, asphalt batching plants, concrete batch plants and other installations where bins are used are described in 20-page catalog from the Bin-Dicator Co., 13946 Kercheval Ave., Detroit 15, Mich. Check the reply card.

Helpful Engineering Data on Cast Iron Pipe

422. Complete data on McWane Super-DeLavaud centrifugally cast pipe with bell and spigot or mechanical joints is contained in Bulletin WP-54, issued by McWane Cast Iron Pipe Co., Birmingham 2, Ala. Size range includes 2" through 12" diameters, 18 feet long.

U. S. Tyton Joint Pipe

490. An eight page booklet on centrifugally cast, Tyton joint pipe for water or other liquids has been announced. The newly developed Tyton joint is simple, sturdy and tight. Illustrations show details of joint and method of assembly. Write U. S. Pipe & Foundry Co., Birmingham 2, Ala., or check the reply card.

V-Notch Chlorinator For Chlorine Flow Control

502. An 8-page catalog on the W & T Series A-721 chlorinator is available from Wallace & Tiernan Inc., 25 Main St., Belleville 9, N. J. Chlorinator is adaptable to any type of chlorinator control and feed rate may be controlled manually or automatically.

Floatless Liquid Level Controls

513. Catalog describes the B/W system of liquid level control, liquid level relays, electrodes, signals and alarms with descriptions, charts and diagrams of typical applications. Check the reply card or write B/W Controller Corp., Birmingham, Mich.

Modern Elevated Water Tanks

566. A 16-page bulletin describing 2 types of water storage tanks, the watersphere and the waterspheroid, is available from the Chicago Bridge & Iron Co., 332 South Michigan Ave., Chicago 4, Ill. Standard sizes from 25,000 gals. to 500,000 gals. are covered.

Water Measurement and Recording Instruments

582. Bulletin No. 314-1 covers water control equipment with emphasis on propeller meters and their construction features. Recorders and their application and remote controlling are also covered. Check the reply card or write Sparling Meter Co., 201 North Temple City Blvd., El Monte, Calif.

Diatomite Filters in Water Filtration

596. A new line of IWF diatomite filters is featured in this 10-page Bulletin 651 by the R. P. Adams Co., Inc., 328 East Park Drive, Buffalo 17, N. Y. The IWF is ideal for medium and small town water supplies and the bulletin provides installation drawings, sectional views and operational sketches.

Data on Mechanical Joint Tapping Valves and Sleeves

605. Eddy mechanical joint tapping valves and sleeves are described in literature available from Eddy Valve. Also described are repair sleeves for cast iron and asbestos cement water mains. Write Eddy Valve Company, Waterford, New York, or circle the reply card for your copy.

For Prompt Service Use The Reply Card

Filter Sands and Under Drain Gravels

614. Filter sands and gravels for municipal water plants are described in literature available from Eau Claire Sand & Gravel Co., Eau Claire, Wis. Check the reply card for data on sizes available, silica content and content of magnesium, calcium carbonates and iron oxides.

Water Tanks, Reservoirs and Standpipes

631. Data on steel water tanks, reservoirs and standpipes of all capacities are included in literature available from Graver Tank & Mfg. Co., Inc., East Chicago, Ind. These units are fabricated and erected by the company. Check the reply card.

Turn Your Water Meter Reading Inside-Out

671. The Visi-Meter is a remote recording and indicator system that eliminates the need of entering the home to read water meters. It records within an accuracy of 0.1 percent. Check the reply card or write Visi-Meter, Inc., 301 North 17th St., Kansas City, Kans., for literature.

Electronic Locators for Water Mains, Services, Valves and Boxes

677. Miniaturized line locator that is encased in a molded glass fibre container and has transistors that have a rated life of 70,000 hours is described in literature from Wilkinson Products Co., 3987 Chevy Chase Drive, Pasadena 3, Calif. Check the reply card.

Calgon TG For Better Corrosion Control in Water Systems

780. Calgon Composition TG is a sodium-zinc hexametaphosphate corrosion inhibitor for municipal water systems. Bulletin 420-12-9 is available from Calgon Co., Hagan Chemicals & Controls, Inc., Hagan Bldg., Pittsburgh 30, Pa., or by checking the reply card.



Two Permutit Precipitators treating 12 million gpd at the Eagle Point Water Plant, Dubuque, Iowa. Plant designed by Consoer Townsend & Associates, Chicago, Ill.

The raw water's loaded with problems, but Dubuque gets 100-hour filter runs with Permutit Precipitators

Influent at Dubuque's new Eagle Point water treatment plant is loaded with iron, manganese and a hardness of 330 ppm. When you're working with raw water like that, the chances for long filter runs would ordinarily be slim.

Yet two vertical Permutit *Precipitators* hold their blankets effectively even while handling the precipitates from this highly mineralized raw water. The effluent they produce is so low in floc-carryover that very little load is placed on the filters. Result: Getting 100-hour filter

runs is no problem at all. Precipitation is complete, and there's no troublesome lime build-up on the filter sand.

The high efficiency of the *Precipitator's* unique upflow sludge blanket has shown up fast in low operating costs for the Eagle Point plant. Long filter runs mean less treated filter wash water is used, hence pumping and chemical costs are both reduced.

Permutit can help you come up with the right answer to your community's water problems. Just con-

tact the Permutit office listed in your phone book. Or write to us directly. The Permutit Company, Dept. PW-12, 50 West 44th Street, New York 36, New York, or Permutit Company of Canada Ltd., Toronto 1, Canada.

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Water Conditioning
Ion Exchange • Industrial Waste Treatment

To order these helpful booklets check the reply card opposite page 40.

SEWERAGE AND WASTE TREATMENT

What You Should Know About Trickling Filter Underdrains

20. Specifications for vitrified clay under drain blocks conforming to ASTM standards, suggestions for layouts and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Trickling Filter Floor Institute, c/o Editor, Public Works, 200 So. Broad St., Ridgewood, N. J. Check the reply card and we will forward your request.

How to Make Better Sewer Pipe Joints

37. How to make a better sewer pipe joint of cement—tight, minimizing root intrusion, better alignment of joint. Permits making joints in water-bearing trenches. General instructions issued by L. A. Weston Co., Dept. F.W., Adams, Mass. Check the reply card.

Theory of Controlled Digestion With Floating Cover Tanks

88. In an excellent 40-page booklet, an authoritative discussion of digestion theory and practices, including design, operation and economics is presented by the Pacific Flush Tank Co., Chicago 13, Ill. Complete data are given on the use of floating covers, together with details on tank construction, piping and control chambers.

Buckets and Grapples For Incinerator Service

110. Bulletin provides comprehensive information on the 5 sizes of 2-line, lever arm, clamshell-type buckets; standard 2-line, tine-type grapples; equalizer arrangements and certain incinerator buckets for single drum hoists. Check the reply card or write Blaw-Knox Co., 300 Sixth Ave., Pittsburgh, Pa., today.

A Handbook of Sewer Cleaning Methods and Materials

44. Complete easy-to-follow directions for every type of sewer cleaning operations and the equipment needed for effective cleaning work is covered in a 48-page booklet issued by Flexible Inc., 3786 Durango, Los Angeles 34, Calif. Full details are provided on power cleaning machines, the SewerRodeK, hand tools and all accessories. Water main and culvert cleaning methods are included.

Sewer Design Flow Chart Based on Manning Formula

154. A large-scale, convenient flow chart based on the Manning formula, together with typical examples of use, is available from Johns-Manville, 22 East 40th St., New York 16, N. Y. To get your copy check the reply card or write to the manufacturer and ask for Bulletin TR-94A.

A Short Course In Pipe Jointing

169. The story of rubber couplings for clay and concrete pipelines is graphically presented in the booklet "Pipe Enterprise", published by Hamilton Kent Mfg. Co., Kent, Ohio. Detailed description of pipe jointing methods; photos showing jobs where Tylox gaskets met the need for easily assembled permanently tight joints installed under all conditions; and a report on the development, manufacture and outstanding features of the compression type gasket make this booklet valuable to every engineer and contractor. Check the reply card.

Engineering Data Manual on Underground Lift Stations

218. This 100 page manual includes descriptive bulletins, specifications covering typical installations for pump type or ejector type stations, friction loss tables covering capacities and size of pipe, pump and motor selection charts and wiring diagrams. Check the reply card or write Smith & Loveless, Inc., Water and Sewage Equipment, P. O. Box 8884, Kansas City, Mo.

Improved Design of Uniflow Settling Tanks

258. Bulletin No. 2648 on the Uniflow settling tank for removal of solids from water, sewage and industrial waste is available from Link-Belt Co., Colmar, Pennsylvania. This bulletin is of great value to engineers who are designing settling tanks. Check the reply card.

How to Dispose of Sewage and Industrial Sludges

281. Get full information on the C. E. Raymond System of combined incineration and sludge drying providing high temperature deodorizing for nuisance-free sludge disposal. Flexible layouts fit large and small communities. Use handy reply card or write Combustion Engineering Inc., Raymond Div., 1315 No. Branch St., Chicago, Illinois.

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Pneumatic Sewage Ejector Pumping Systems for Low Flows

317. Dimension and capacity tables for pneumatic float or electrode controlled ejectors, cast iron or welded steel, covering flow ranges of 20 to 600 gpm, including all information necessary in design are given in Bulletin No. KSM-2 3/58. Check the reply card or write Kamline-Sanderson Engineering Corp., 101 Holland Avenue, Peapack, N. J.

Centrifugal and Turbine Type Pumps For Water and Sewage Plants

321. Turbine-type pumps, close or flexible couple drive, side suction centrifugal pumps and mixed flow pumps are described in Catalog M available from Aurora Pump Div., The New York Air Brake Co., Loucks at Dearborn, Aurora, Ill. Included is a pump selection guide and spigot pipe. Check the reply card.

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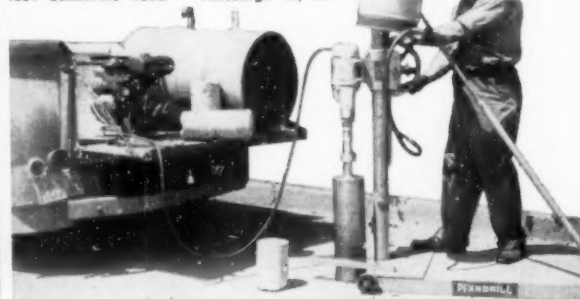
The Pennndrill Model "E" is a complete drilling unit, easily operated by one man and drills holes from 1 to 14 inches in diameter up to 19 inches deep—drills vertically, horizontally or at any angle.

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NEW MODEL 507



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- New easy-open case is finished in textured green

For further details, write for Bulletin C-123



**AUTOMATIC SIGNAL DIVISION
EASTERN INDUSTRIES, INC.
NORWALK, CONNECTICUT**

To order these helpful booklets check the reply card opposite page 40.

Literature on Concrete Sewers

270. Literature on concrete sewers is available from Portland Cement Association, Dept. 10-89, 33 West Grand Ave., Chicago 10, Ill. Check the reply card for data on concrete for all modern pipelines.

Renew Pipe Performance With Cement Mortar Lining

322. Application of the Tate and Spunline process for cement mortar lining of existing pipe lines with a minimum of interruption of service is described, with diagrams, photographs and specifications in Catalog 15-58. Write to Pipe Linings, Div. of American Pipe and Construction Co., P. O. Box 457, Wilmington, Calif., or check the reply card.

Improved Method for Supplying Activated Sludge Process Demands

356. Bulletin No. 7316 describes the development, design and advantages of this improved method for supplying oxygen demands in the activated sludge process. Check the reply card or write Durr-Oliver Inc., Stamford, Conn., for cutaway wash drawings of typical aerator installations and an activated sludge flowsheet.

Diesel Engines For Municipal Power Needs

359. Dependable power for water supply or flood control pumping stations, stationary or portable electric plants and many other municipal needs can be provided by engines described in literature of the Enterprise Engine & Machinery Co., 18th & Florida Sts., San Francisco 10, Calif.

Packaged Activated Sludge Plants

406. Packaged sewage treatment plants for small installations utilizing the activated sludge process are covered in Bulletin No. 22579 available from Walker Process Equipment Inc., Aurora, Ill. Check the reply card for design drawings and specifications.

Getting Improved Sludge Dewatering With Non-Clogging Vacuum Filters

425. Latest information on the Komline-Sanderson "Coilfilter," which features non-clogging, permanent filter media to obtain constant output and low operating cost is presented in illustrated Bulletin No. 106 by the Komline-Sanderson Engineering Corp., Peapack, N. J. Be sure to investigate this improved method of sludge dewatering. Check the reply card today.

Vitrified Clay Floor System For Trickling Filters

452. The IMCO two unit floor is noted for its mechanical strength, simplicity of construction and large percentage openings for aeration. The units are self spacing and easily set in place. Check the reply card or write Industrial Materials Co., Somerset St. and Trenton Ave., Philadelphia 34, Pa., for complete catalog.

Butterfly Valves For Water and Sewage Treatment Plants

507. Rubber seated butterfly valves are described and illustrated in a new two-color Bulletin No. 5603, available from F. B. Leopold Co., Inc., 227 So. Division St., Zionsville, Pa. Complete details on the performance and construction features of the valve are included.

Pressure Operated Sump Controls Used in Pumping Stations

525. Literature is available from Healy-Ruff Co., 2255 University Ave., St. Paul 14, Minn., describing controls used in the control of liquid level in sumps and wet wells and single and multi-pump controls for pumping stations and sewage plants. Check the reply card.

Book Describing Methods of Aggregate Preparation

565. A 40-page book describing methods of aggregate preparation, beneficiation and handling has been prepared by Wemco Products Div., Western Machinery Co., 650 Fifth St., San Francisco 7, Calif. Check the reply card for complete engineering data.

Manual on Solving Drainage Problems

554. A 74-page Manual on the problems of drainage and drainage materials is available. Design section includes determining culvert lengths and sizes, run-off calculations, excavation of base and backfilling data. Check the reply card or write Bethlehem Steel Co., Bethlehem, Pa., for this valuable book.

Press-Seal Rubber Gaskets to Seal Joints of Concrete Pipe Sewers

623. Rubber gaskets for sealing the joints of concrete sewer pipe are described fully in literature available from Press-Seal Corp., P. O. Box 482, Fort Wayne, Ind. Check the reply card for information on how these gaskets prevent water infiltration in sewer lines.

Engineered Electrical Systems for Sewage Treatment Plants

634. General Electric equipment can help you achieve efficient, economical sewage plant operation. Write to G-E Apparatus Sales Office, General Electric Co., Schenectady 5, N. Y., for complete coverage of these electrical systems or check the reply card.

Reinforced Concrete Pipe For Culverts and Sewers

672. Elliptical Lo-Hed and Hi-Hed pipes, round pipe and flat base pipe are described fully in literature from American-Marietta Co., Concrete Products Div., 101 East Ontario St., Chicago 11, Ill. Headwall details, discharge curves, hydraulic capacity tables and hydraulic properties are included. Check the reply card.

Information on Welded Wire Fabric

729. Reinforced concrete sewer and culvert pipe that are made with U.S.S. American welded wire fabric are described in literature from American Steel & Wire Div., United States Steel, Cleveland, Ohio. Check the reply card for specifications and engineering data.

the process... AERATION, OXYGENATION
Sewage and Waste Treatment

the equipment... **SPARJERS**
WALKER PROCESS

DIFFUSAIR
SPARJERS



Diffusair SPARJERS, developed by Walker Process, represent years of research and experimentation along with a continuing study of oxygenation processes. As the number of new and tube replacement installations increase, more and more Engineers and Plant Superintendents recognize that SPARJERS successfully combine controlled air bubble release with increased tank turbulence and circulation velocities to achieve an oxygenation efficiency actually superior to other types of diffusion devices. SPARJERS provide maximum oxygen absorption and include such features as CLOG-PROOF SELF CLEANING ORIFICES . . NO AIR FILTERS REQUIRED . . POSITIVELY NO BACK PRESSURE BUILD-UP . . ECONOMICAL OPERATION.

Full-sized plant tests conducted in recent years have demonstrated the SPARJER'S superior design. In many cases they are installed on existing headers which formerly supported diffusion tubes. Bulletin 22-5-90 discusses the theory and development of SPARJERS and presents actual plant experiences and data. Write for your copy today.

WALKER PROCESS

WALKER PROCESS EQUIPMENT, INC.
FACTORY • ENGINEERING OFFICES
LABORATORIES
AURORA, ILLINOIS

Chevrolet's new El Camino combines fresh beauty with a husky pickup box that's 76¼" long, 64¼" wide.



THE BEST YET OF THE BEST SELLERS...

CHEVROLET TASK-FORCE 59 TRUCKS



Here's the best built dump truck you can buy—a 1959 Chevrolet middleweight with rugged chassis constructed to stay on the job for years!

For '59, the brightest new ideas in trucks are Chevrolet's! There's the new El Camino to set a new standard in styling... new features and refinements in every model to set new records for saving!

Here is the soundest, savingest, sharpest looking line of haulers that ever hustled a load! For evidence, consider the dazzling new El Camino. It combines slimlined beauty with the ability to handle man-size hauling jobs!

Or take the pickups of Task-Force 59—a dozen big-bodied beauties that suit scores of jobs with five handsome Fleetside models and seven handy Stepside models!

A new edition of the famous Thriftmaster 6, standard in light-duty models, gives up to 10% greater fuel economy—up to 20% with new maximum economy option*. And in the medium- and heavy-duty classes, you'll find new V8 power... axles, transmissions, frames and brakes that are refined and improved to whip the toughest runs.

Whether your truck is a light-, medium-, or heavy-duty job, these are trucks you've got to see! They're on display right now at your Chevy dealer's... Chevrolet Division of General Motors, Detroit 2, Michigan.

**Optional at extra cost.*

NEW MIGHT, NEW MODELS, NEW MONEY-SAVING POWER!



To order these helpful booklets check the reply card opposite page 40.



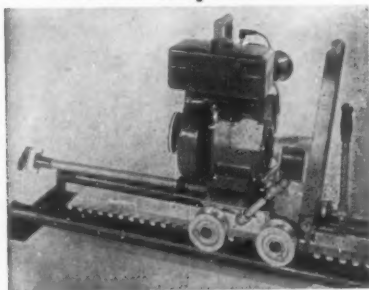
TWO PIECE
sliding or screw type
cast iron valve boxes
for covering 4" thru 10"
valves for water or gas.
Rugged construction
for lifetime service.
5 1/4" shaft. Extensions
as required.

**Adjustable
VALVE BOXES
THREE PIECE**
valve boxes supplied
with separate bases
are available in sliding
or screw type. Made
with 5 1/4" and 7" shafts
with extensions as re-
quired. Complete line
of service and road-
way boxes.

ALABAMA PIPE CO.
We Invite Inquiries to Our Nearest Sales Office
120 S. Michigan Ave. / 350 Fifth Avenue
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General Sales Offices
ANNISTON, ALABAMA

APCO

EBMI Underground Boring Machine New! Improved!



Model 40

- **BORES**—with no surface break
 - **BORES**—up to 250 feet in length
 - **BORES**—up to six inches diameter
 - **BORES**—so drill stem of pipe of conduit stays
 - **BORES**—1,000 feet on 1 Gal. of gas
 - **REAMS**—up to 12 inches diameter
- Write immediately for information.

EARTHWORM BORING MACHINE, INC.

P. O. Box 1100
Santa Monica, California

REFUSE COLLECTION AND DISPOSAL

Refuse and Garbage Packer Bodies

241. Ranging in capacity from 12 to 24 cu. yds., the M-B packers have a 30 second compaction cycle and have large side loading doors. Write M-B Corp., New Holstein, Wisc., or check the reply card for bulletin on specifications.

General Specifications for Refuse and Garbage Trailers

251. Two bulletins, one on the Pak-Mor 38 cu. yd. tandem axle trailer unit and the other on the Pak-Mor 32 cu. yd. trailer for use with Model GRD Dempster are available from Pak-Mor Manufacturing Co., Box 6147, San Antonio, Texas. General specifications, power train, operating procedures, maintenance and lubrication and other helpful information are included.

Planning A Sanitary Landfill

267. Covered in this manual is how to work various types of terrain efficiently for sanitary landfills. Swampy land, river bottom land, gravel pits, strip mines, and flat land operation are the sections. Write to Caterpillar Tractor Co., Peoria, Ill., or check the reply card for your copy.

How to Construct A Sanitary Fill

331. A new 12-page booklet which tells the most efficient method of sanitary fill construction and furnishes complete information on planning and operation is now available from Drott Mfg. Corp., Milwaukee 15, Wis. Get your copy by checking the reply card; you'll find this booklet both interesting and valuable.

Methods and Benefits of Sanitary Landfill

409. Information on Sanitary landfill methods, organization and necessary equipment with which to carry out the job is available from the Construction Machinery Div., Allis-Chalmers Mfg. Co., Milwaukee 15, Wis. Check the reply card today.

Information on the Hydepak Refuse Packer

437. The Hydepak refuse packer is designed so that a lighter more economical truck body can be used and the packer is available in 13, 16, 20 and 24 yd. capacities. For complete specifications write Hydepak Division, Hobbs Trailers, 609 No. Main, Fort Worth, Tex., or check the reply card.

STREET LIGHTING AND TRAFFIC CONTROL

Get Full Data On the Radar Speed Meter

22. Accurate readings of vehicle speeds, with direct indications in miles per hour and a graphic recorder for permanent record are available by use of the Electro-Matic Radar speed meter, a product of Automatic Signal Division, Eastern Industries Inc., Norwalk, Conn.

Investigate These Street Lighting Standards

54. You can get complete data on Kerrigan factory-built "Weldforged" street lighting standards, brackets and mast arms by using the handy reply card. Check these strong, well designed, inexpensive steel standards for practical street and highway lighting. Handsome 26-page folder includes data sheets on floodlighting and area lighting applications. Kerrigan Iron Works, 1033 Herman St., Nashville, Tenn.

Residential Street Lighting

228. A new 16-page bulletin on residential street lighting is now available from the General Electric Co., Schenectady 5, N. Y. Well illustrated, the bulletin, designated GEA-6316, explains how good lighting benefits a residential community and provides information on how to plan modern residential lighting installations.

Practical Outdoor Lighting

489. P & K luminaires and standards for outdoor lighting provide good lighting and complement the architecture and design. Check the reply card or write Pfaff & Kendall, 84 Foundry St., Newark 5, N. J., for models and types.

SNOW AND ICE CONTROL

Get Full Data On Aggregate Spreaders

34. Accurate control for spreading asphalt, crushed rock, chips, sand or ice control materials is featured by all models of Highway Equipment Co. materials spreaders. Data on towed, truck mounted and tailgate types available by checking the reply card. Highway Equipment Co., 630 D. Ave., Cedar Rapids, Iowa.

Uniform Salt Spreading Saves Material

42. The wide, thin pattern provided by Tarco "Scotchman" spreaders avoids salt waste, saves time and labor. Get Folder BL for full details on their spreader and table of material application rates. Use reply card or write Tarant Mfg. Co., Dept. PW, Saratoga Springs, N. Y.

Bare Pavement Maintenance With Sterling Rock Salt

84. Handbook is designed for road maintenance men who are responsible for safe winter pavements; and is a safe-roads fact book about a modern snow and ice removal program. Check the reply card or write International Salt Co., Inc., Scranton, Pa.

Reversible and Roll-Over Type Snow Plows for any Depth of Snow

389. Village, city, county, state and airport officials send for the latest information on Frink's two catalogues on reversible trip-blade and roll-over snow plows. Complete assembly details, specifications and operation are completely outlined. Write to Frink Sno-Plows, Inc., Clayton, New York.

How to Make Icy Surfaces Safe

455. A bulletin on how calcium chloride works in ice control and directions for its use has been made available by Wyandotte Chemicals Corp., Michigan Alkali Division, Wyandotte, Michigan. Other uses of calcium chloride are fully outlined.

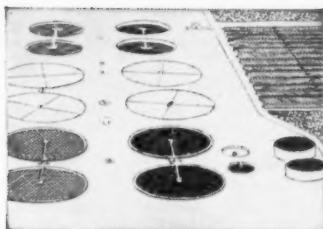
Rock Salt For Ice and Snow Removal

534. Application rates and procedures of using Morton rock salt for ice and snow control are covered in catalog from Morton Salt Co., 110 No. Wacker Drive, Chicago 6, Ill. Check the reply card for Catalog F-35.

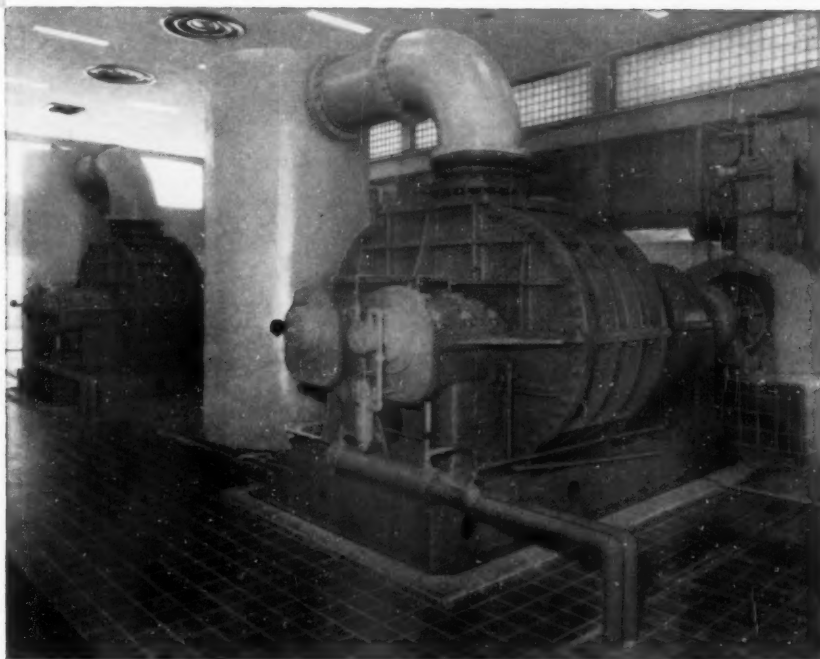
RECREATION

Rubberized Playground Surfacing Material

668. Saf-Pla can be applied to black top, concrete or properly surfaced areas to reduce injuries from children falling. Check the reply card or write to U. S. Rubber Reclaiming Co., Inc., Box 365, Buffalo 5, N. Y.



For waste treatment



R-C blowers give engineers these 7 design advantages

In the modern South Bend, Indiana sewage plant, two R-C Rotary Positive Blowers rated at 19,000 cfm, 7½ psig, 327 rpm, 735 Hp are direct connected to engines. Consoer, Townsend & Assoc.—Consulting Engineers.

For sewage or waste treatment application, Roots-Connorsville blowers offer maximum design freedom and flexibility.

- **Capacity range**—up to 25,000 cfm for pressure to 10 lbs in single-stage units. For larger volumes, R-C offers single and multi-stage centrifugal blowers.
- **Speeds**—higher speeds develop same cfm in smaller units, reducing weight, floor space, first cost.
- **Efficiency**—minimum slippage loss assures high volumetric efficiencies; constant volumes delivered regardless of pressure requirement.
- **Operating economy**—horsepower determined by actual operating pressure; minimum maintenance and downtime.
- **Drive flexibility**—may be direct-connected to electric motors or gas engines, and with V-belts or reduction gears.
- **Low friction**—negligible loss from surface friction, no loss from internal mechanical friction.
- **First cost**—smaller units save foundation and installation costs, satisfy strict budgeting.

For design information and specification data, ask for Bulletin RB-154 or call your Roots-Connorsville Field Engineer.



ROOTS-CONNERSVILLE BLOWER

A DIVISION OF DRESSER INDUSTRIES, INC.

1258 Poplar Ave., Connorsville, Indiana. In Canada—629 Adelaide St., W., Toronto, Ont.



To order these helpful booklets check the reply card opposite page 40.

STREETS AND HIGHWAYS

Automatic Sample Driver For Sub-Surface Exploration

49. This compact portable drilling unit features augering, driving and core drilling for sub-surface exploration. Check the reply card or write Penn-drill Mfg. Div., Pennsylvania Drilling Co., 1201-1205 Chartiers Ave., Pittsburgh 20, Pa., for full information.

Graders With Torque Converters and Power Shift Transmissions

142. Described in Bulletin No. HWG-508 is the Huber-Warco 50-190, 195 hp grader. Features include power sliding moldboard, easy to reach controls, four-wheel brakes and retractable scarifier. Write Huber-Warco Co., Marion, Ohio, or check the reply card.

Tractor Loader Can Be Converted Into Eight Different Machines

38. Multiple-purpose tractor loader can be converted to a street sweeper, backhoe, fork lift, angle dozer, crane and rotary broom in a short time. Check the reply card or write Massey-Ferguson Industrial Div., 1009 South West St., Wichita 13N, Kans., for well illustrated catalog.

Use The Reply Card

Utility Tractors For Many Jobs

94. A pictorial review of the Allis-Chalmers D-Series utility tractor line is available from Allis-Chalmers Mfg. Co., Tractor Group, Milwaukee, Wisc. Check the reply card for specifications and dimensions of the D-14 and D-17 tractors.

Inexpensive Ditcher Handles Heavy Diggings

91. The Shawnee Scout Ditcher, a heavier model for extensive digging, has been added to the Shawnee line of ditchers and dozers. All models are designed to handle ditching and backfilling operations quickly, efficiently and at low cost. Full information on this equipment will be sent by Shawnee Mfg. Co., 1947 N. Topeka, Topeka, Kansas.

Non-Electric Traffic Control Products

156. Reflective pavement marking glass beads, Catalflex "202" reflective coating, Catalflex reflective striping, Catatherm reflective plastic striping, plain and reflective street and highway signs, plain and reflective street name signs are covered in literature from Cataphote Corp., P. O. Box 2066, Jackson, Miss.

Hydra-Drives Power Shift Transmissions

283. With four speeds forward and reverse, the Hydra-Drives is ideally suited for vehicles which must travel in both directions during a normal work cycle. Check the reply card or write Rockwell-Standard Corp., Transmission and Axle Div., Detroit 32, Mich., for full details.

Specs For Aluminum Increment Sheet Highway Traffic Signs

377. Installation procedures, bid specifications and general information on aluminum traffic signs are covered in Bulletin 58 R from Traffic and Street Sign Co., 84 Foundry St., Newark 5, N. J. Check the reply card for data on methods of erection, wind loadings and other details.

IHC Crawler Tractors For Highway Construction

491. Information on the new International TD-6, TD-9, TD-14 and TD-18 diesel crawler tractors is contained in 8-page, 2-color booklets available from Consumer Relations Dept., International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill. Mechanical features and specifications, engine power, and operation are fully covered.

Crezon Plywood Signs Have Long Life Expectancy

441. Crezon overlaid plywood signs are described fully in literature available from Crown Zellerbach, San Francisco 19, Calif. Material is strong and rigid, resists bending or tearing loose from the pole and there's neither checking nor blistering from heat or freezes.

Chevrolet Trucks for 1959

642. Chevrolet trucks for 1959 feature more models, thriftier engines, stronger cabs and frames, safer brakes and tougher axles and transmissions. Write to the Chevrolet Div., General Motors, Detroit 2, Mich., or check the reply card for complete data on these new trucks.

Aluminum for Complete Line of Signs and Sign Blanks

675. Valuable information on aluminum's advantages, features and economies, plus details on application of all sign message materials are covered in the aluminum sign bulletin from Kaiser Aluminum & Chemical Sales, Inc., Dept. MU-936, 919 N. Michigan Ave., Chicago 11, Ill. Check the reply card today.

Construction Guide For Engineers and Builders

669. A 34-page four sectioned construction guide containing full-page structural drawings that provide basic information on types, grades and applications of fir plywood for engineers and builders has been released by Douglas Fir Plywood Association, Tacoma 2, Wash. Check the reply card for data on floor construction, single and double wall construction and roof construction.

Attachments For Ford Tractors

643. Clearing, backfilling, ditching, excavating, mowing, scarifying, sweeping, and trenching equipment are a few of the attachments described in literature from Tractor and Implement Div., Ford Motor Co., 2500 East Maple Road, Birmingham, Mich.

(More listings on page 56)



"Cuts maintenance to the bone"



PACKAGED SIGNS SPEED INSTALLATION

To the natural advantage of light weight, Tassco provides these aluminum signs in pre-arranged packages ready for installation. The easy-to-handle panels are assembled on the job site and mounted in a matter of minutes.



TRAFFIC AND STREET SIGN COMPANY
84 FOUNDRY STREET, NEWARK, N.J.

This is North Carolina's new Route 85, by-passing cities, moving traffic quickly with the help of a signing program by Tassco. The complete program consists of ground mounted and overhead signs. The signs themselves are increment sheet signs developed by Tassco especially for use on modern, high-speed roads. They can be had in any height or width and are designed to meet 100 mph wind loads. The use of increment sheets means new lows in the cost of both materials and installation. But what is most important, since the State has to bear the costs of maintenance, is that with 1193 signs, 501 sign supports, and with 9 large sign spans, not one drop of paint is required for maintenance.

North Carolina's signs feature the approved reflectorized green background with white AGA letters. However, reflective material or painted backgrounds are available in any type letters or symbols. Helpful data, including a full color movie, is available from the Tassco-P & K Highway Planning Committee. Write for "Committee Data" today.

CALGON®



CONTROLS



TUBERCULATION

Tuberculation cuts down flow capacities . . . raises pumping power requirements . . . steps up costs. Calgon provides the simple, economical way to control this costly corrosion.

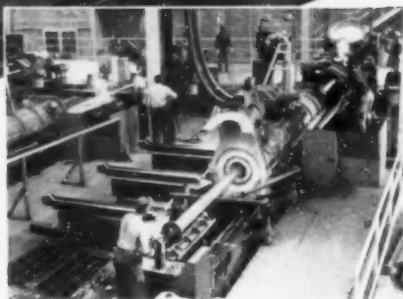
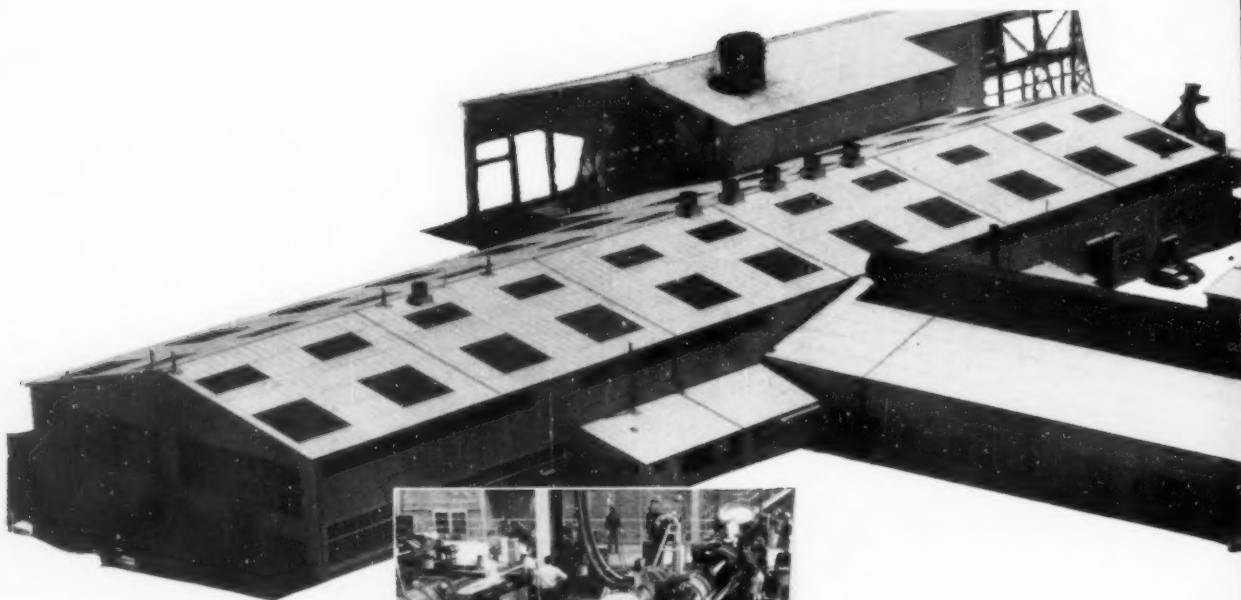
Calgon treatment is particularly effective after mechanical main cleaning because of its fast film-forming ability. Protection for freshly scoured metal surfaces is quickly built up and easily maintained. Calgon treatment is as inexpensive as it is effective—a few ppm control tuberculation and other corrosion problems as well.

A letter or phone call will bring you more information on how Calgon can help. Or, an experienced Calgon engineer will be glad to make detailed recommendations on your specific problem.

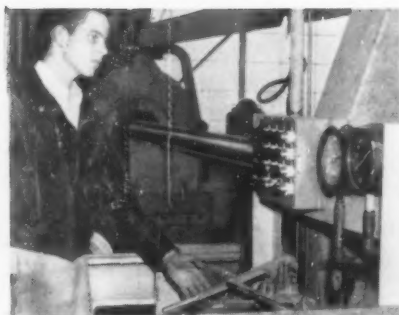
CALGON COMPANY



DIVISION OF **HAGAN** CHEMICALS & CONTROLS, INC.
HAGAN BUILDING, PITTSBURGH 30, PENNSYLVANIA
DIVISIONS: CALGON COMPANY, HALL LABORATORIES
IN CANADA: HAGAN CORPORATION (CANADA) LIMITED, TORONTO



Using the metal mold process, the new casting machines at Bensenville include many patented improvements which are unique with Clow.



Testing is a continuous phase of the manufacturing process. All Clow pipe is subjected to a hydrostatic test of 500 lbs. per sq. inch of water pressure—2 to 4 times the normal working pressure.

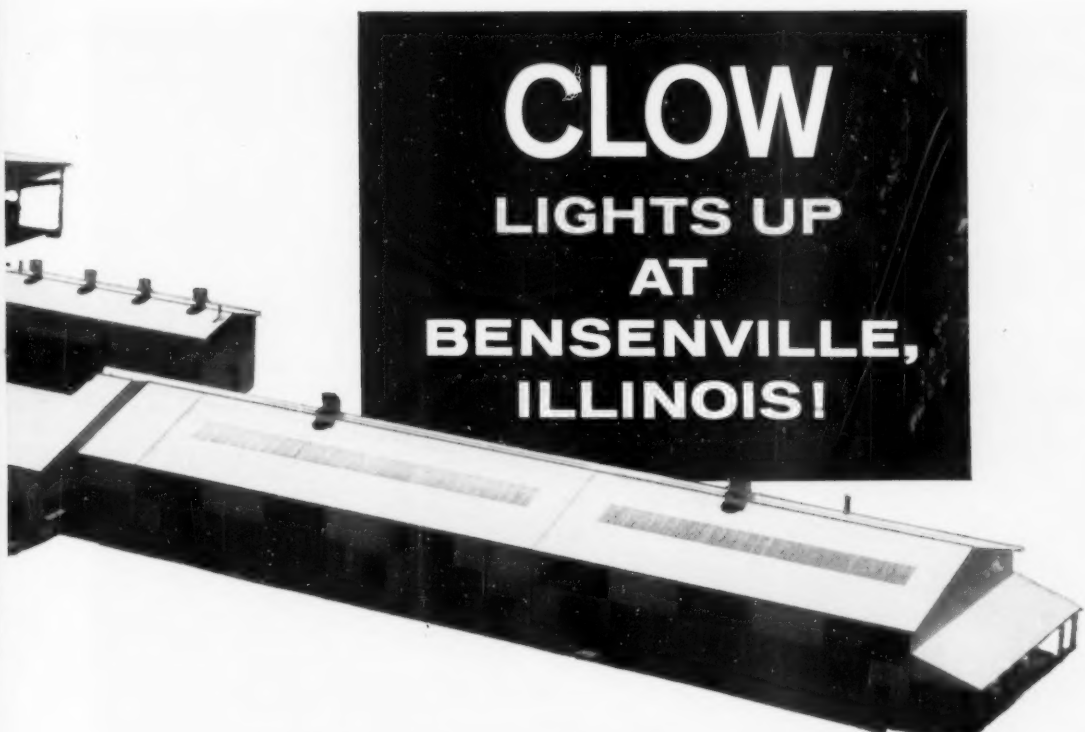
CONTROL... The Key to Clow's High Quality



Clow cast iron pipe quality is assured by automatic instrument control during manufacture. In some cases, these control systems were developed exclusively for Clow.



Pipe annealing, a vital step in making Clow cast iron pipe, is carried out in this annealing oven—the most modern of its kind.



CLOW LIGHTS UP AT BENSENVILLE, ILLINOIS!

New Cast Iron Pipe Plant Begins Production to Meet Growing Midwest Market Demands

On September 22, 1958, the first pipe was poured at the new Bensenville, Illinois, Works of JAMES B. CLOW & SONS, INC., starting production at the most modern cast iron pipe plant in the world. The first plant ever constructed in the central states area for making cast iron pipe, Bensenville is located in suburban Chicago and is ideally situated to meet present and future demands for Clow pipe. By bringing producer and users hundreds of miles closer together, this new manufacturing plant will be able to deliver dependable Clow cast iron pipe *faster* for all construction needs. Bensenville is strategically located for shipment by rail, or by truck over the modern new highway network of the Chicago area. In addition, customers will benefit from new efficiencies of modern mass production in a plant located in an area central to vital raw materials for making cast iron pipe.

The inauguration of pipe production at Bensenville marks another step in Clow's continuing expansion program. Clow now operates pipe plants at Coshocton, Ohio, and Birmingham, Alabama, in addition to Bensenville. Bensenville is another major Clow investment in better products to better serve its customers.

OUR 80th YEAR • 1878 TO 1958

CLOW CAST
IRON
PIPE

JAMES B. CLOW & SONS, INC.

201-299 North Talman Avenue, Chicago 80, Illinois

To order these helpful booklets check the reply card opposite page 40.

CONSTRUCTION EQUIPMENT AND MATERIALS

What You Should Know About Air-Placed Concrete

67. For a detailed explanation of the principle of "gunned" or "air-placed" concrete and description of the improved Model 750 and 1250 Bondactors, be sure to get your copy of Form 553 from Air Placement Equipment Co., 1011 W. 24th St., Kansas City 8, Mo. Check the reply card today.

Useful Attachments for "Payloador" Tractor Shovels

95. Increased versatility for Hough "Payloador" tractor shovels is made possible by the various attachments described in literature of the Frank G. Hough Co., 761 Seventh St., Libertyville, Ill. Illustrated and described are rotary "V" and trip-blade snow plows, hydraulic backhoe, back-filler blade, pickup sweeper, scarifier teeth, winches, etc.

Check List for Successful Earthmoving Bids

147. Valuable information for the earthmoving contractor and for the engineer who must estimate earthmoving costs is provided in a new two-color illustrated booklet issued by Caterpillar Tractor Co., Peoria, Ill. A convenient check list is included to help select the proper equipment for the job. Check the reply card to get Form No. DE502.

Utility Tractor For Construction and Maintenance

232. Bulletin CR-1333-G describes the performance and handling ease of the International 350 utility tractor. Advantages, special features and specifications are included. Check the reply card or write Construction Equipment Div., International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill.

Convertible 1/2-yd. Hydrohoe, Hydroshovel and Hydrocrane

338. The Bucyrus-Erie H-5 Hydrohoe combines high production with mobility and flexibility. Check the reply card or write Bucyrus-Erie Co., South Milwaukee, Wisc., for details on this unit that can be converted to a crane, clamshell, backhoe and shovel.

Information on Boring Machines

345. General operating instructions for the Earthworm boring machine, a portable compact unit for underground installation of pipe and conduit are available in new bulletin just released by Earthworm Boring Machine, Inc., P. O. Box 1100, Santa Monica, Calif. Suggested procedures for installing pipe or conduit and a price list are included.

4-Wheel Drive Tractor Loaders

434. A 16-page Catalog, No. 1033-5-57, describing the "Tracto-Loader Line" of front end wheel loaders is available from Tractomotive Corp., Deerfield, Ill. Covered are the five models that are in production.

Power Shovel, Crane and Backhoe All in One Unit

441. A completely hydraulic backhoe, shovel loader and crane all in one unit is described in literature available from the Badger Division of Warner & Swasey Co., Winona, Minn. Also information on front-end loaders, truck and trailer mounted hydraulic backhoes and various attachments that are useful for contractors, municipal and county engineers and state highway engineers. Check the reply card.

Catalog on Steel Grating

665. New ideas in flooring, walkways, stair treads, platforms and shelving are covered in Catalog 2527 available from Blaw-Knox Co., Dept. W., Pittsburgh 38, Pa. Check the reply card for information on choice of cross bar and bearing bar designs and spacings.

Drilling Machine For Concrete

221. The Truco diamond drilling machine is described in literature available from Truco Swivel Div., Wheel Trueing Tool Co., 15-3200 W. Davidson Ave., Detroit 38, Mich. Unit will cut, reinforced or plain concrete. Check the reply card.

Principles of "Batchomatic" Plants Explained

527. The unique principles of simultaneous and fully automatic aggregate and bitumen measuring followed on Barber-Greene's 2,000, 4,000 and 6,000 lb. "Batchomatic" bituminous batch plants are explained with cut away drawings, charts and other illustrations in a 3-color bulletin offered by Barber-Greene Co., Aurora, Ill. Check the reply card.

Agent For Improving Adhesion Between Old and New Concrete

530. Thorobond liquid bonding agent for improving adhesion of new concrete to old concrete walls, floors and ceilings is described in literature available from Standard Dry Wall Products, Inc., New Eagle, Pa. Check the reply card for information on typical uses and methods of application.

Most Complete Line of Portable Rotary Compressors

698. The Ingersoll-Rand Gyro-Flo is available in 6 sizes—85, 125, 210, 315, 600 and 900 cfm. Write Ingersoll-Rand, 11 Broadway, New York 4, N. Y., or check the reply card for information on these advanced-design rotary compressors.

Slide Rule PSI Calculator For Concrete

713. A new pocket size slide rule calculator for the testing of concrete in compression is available from Forney's Inc., P.O. Box 310, New Castle, Pa. It is designed to convert instantly the pressure applied to concrete cylinders and blocks into psi.

FOUR BIG REASONS for Specifying



Floor System for All Types of Trickling Filters:

- 1-It simplifies construction**—The units are self-spacing; they are easily set; they have high strength, thus permitting mechanical placing of filter stone . . .
- 2-It assures effective aeration**—The grill blocks afford maximum apertures, with 40% of the filter area open to ventilation . . .
- 3-It provides excellent drainage**—The channel blocks are smooth and unobstructed and flush jointed . . .
- 4-It gives flexibility of design**—Filter blocks are supplied in shapes and fractional sizes to fit all forms of filters without the necessity of cutting blocks . . .

Our Engineering Department will gladly cooperate with Engineers in solving the design problems of all standard and high-rate trickling filters.

INDUSTRIAL MATERIALS CO.
Somerset St. and Trenton Ave.
Philadelphia 34, Pennsylvania



With Gliders, there's no "fishing" for prints, no hole-punching as in old peg-type file methods. Your prints "glide" into and out of filing position in clamp-type plan holders.

GLIDER BLUE PRINT RACKS 5' high, 4' wide, 3' deep.

Gliders hold 1200 plans 24" to 48" in width. Plan holder clamps loosened, allow removal of needed prints without disturbing others. Indexes above each plan holder provide quick reference. Gliders are easily expandable, with attachable extensions.

GLIDER "700" BLUE PRINT RACKS 4' high, 2' wide, 2' deep.

The Glider "700" is a modular, strong-steel unit. Designed for planners who have small print filing requirements, it's a space-saver. It retains 700 prints of 18" to 24" widths. Glider "700" provides the same filing efficiency as the Gliders and makes an excellent primary, subsidiary or ready-reference "desk-side" file. The efficient, all-steel Glider line, simple to set up and move, and finished in modern grey enamel, fits the "scheme" of today's offices. Order now through the best office suppliers or write for illustrated literature.



Through the direct clamp design of plan holders, you slip sheets, either singles or sets, in or out without removing others.

Plan holders "glide" in on steel tracks, are secured from end-to-end and "glide" out with little effort.



MOMAR INDUSTRIES 4323 West 32nd St.
Chicago 23, Ill.

REDUCE YOUR REFUSE DISPOSAL COSTS

With These Low-Investment Systems



THE DEMPSTER-DUMPSTER



THE DEMPSTER-DUMPMASTER



THE DEMPSTER
COMPACTION TRAILER



THE DEMPSTER-DINOSAUR

America's Most Complete Line of Refuse Disposal Systems

The big savings in refuse disposal are made with mechanized, containerized, collection equipment. Dempster Brothers, the pioneer manufacturer of containerization equipment, now offers four efficient systems to help you increase your efficiency and decrease costs.

The DEMPSTER-DUMPSTER handles containers up to 15 cu. yds. The DEMPSTER-DUMPMASTER, available in three sizes, picks up and empties containers from one through

six cu. yd. capacity. Compaction bodies are 18, 24 and 30 cubic yards with capacities up to 120 cubic yards of loose refuse. The DEMPSTER Compaction Trailer will hold and haul over 200 cubic yards of loose material per trip and it can be loaded by the DEMPSTER-DUMPMASTER GRD-304-F-2. The DEMPSTER-DINOSAUR offers giant containers up to 40 cu. yds. and over. Write today for complete information.

Mfd. By DEMPSTER BROTHERS
INC.

the originator and only
manufacturer of the
DEMPSTER-DUMPSTER Systems



Dept. PW-12 DEMPSTER BROTHERS

DEMPSTER
SYSTEMS



Knoxville 17, Tennessee

Huber-Warco on the job

BONUS features designed into each
Huber-Warco grader mean
more profitable grading operations



Along the River Road near Warrensburg, New York, a Huber-Warco 7-D grader works at shoulder maintenance for the Warren County Department of Highways.



Here a Huber-Warco 6D-2 grader carries out a ditching assignment for the Clinton County Road Commission of St. Johns, Michigan.

H-W scores on all county

Whether the job requirement is ditching, bank sloping, maintaining shoulders, spreading gravel or just routine grading assignments, a Huber-Warco motor grader will do the job faster and better.

Let's talk about the 6-D and 7-D series graders. These four models have a horsepower range of from 102 to 150 h.p. These powerful diesel engines are combined with a torque converter, power shift transmission and tail-shaft governor.

The torque converter makes more usable power available, brings new ease of operation and protects vital parts. The tail-shaft governor automatically adjusts engine RPM to meet any load condition, maintaining any working speed set by the operator.

The power shift transmission permits quick shifts under full load with no interruption in power flow from the engine to the load. This Huber-Warco power shift transmis-

Terms up to 36 months and
rentals available . . . contact
your Huber-Warco distributor.



TANDEM ROLLERS



MOTOR GRADERS



MAINTAINER



3 WHEEL ROLLERS



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grading assignments

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the cab, is standard. There's no deviation from the line of travel. This enables the operator to keep his wheels on good footing.

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Huber-Warco Company

Marion, Ohio, U.S.A.

Dodson's Digest



About a doubt

One of my customers — Gil Fryer, who is a county highway engineer — is always making tests to compare the merits of the various products he recommends for road maintenance. Long a booster of Calcium Chloride for ice control, Gil even made a test on that ... as I discovered when I called on him recently.

"Hey, Dod!" he had yelled angrily, before I'd had a chance to say hello. "You know how you always said that Calcium Chloride would melt ice over 30 times as fast as salt? How it's effective right down to 59° below? How it anchors itself in? And—"

"Yes, and how it keeps abrasive piles loose in any temperature!" I broke in. "How it won't leave any residue on pavement, floors, or equipment. Sure, what about it?"

"Well," Gil growled, "my tests last night prove that it melts ice like you said. But how do you account for that slick patch where I put it next to our storage shed over there?"

"You mean you were out in that freak ice storm?" I gasped. "Why that pulled the power lines down all around here. How did you see?"

"Finished up in the dark," he flung back. "Had to feel for the last few bags of Calcium Chloride I applied. But the results showed up this morning. In fact, my supply is gone. Rushed the super out early for an emergency order."

Just then the superintendent's pick-up truck came screeching into the yard. Slamming to a stop near the storage shed, it touched the patch of ice, spun dizzily around, and caromed into the frame building with a fender-shattering crash.

Running breathlessly over, we could hear a dazed voice coming from the cab. "It's that Gil and his crazy tests," it groaned. "He scattered my last six bags of sheep manure in this flooded stretch of drive last night and it must have froze solid!" — L. D. DODSON

P.S. — To ensure fewer accidents during the coming months, send for our free booklet, "Melt or Skidproof Icy Surfaces with Wyandotte Calcium Chloride." Just drop me a line. Wyandotte Chemicals Corporation, Wyandotte, Michigan. Offices in principal cities.

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MICHIGAN ALKALI DIVISION
HEADQUARTERS FOR CALCIUM CHLORIDE



LEGAL ASPECTS OF PUBLIC WORKS

MELVIN NORD, Dr. Eng. Sci., LL.B.

Liquidated Damages

Loeb v. Allegheny County, 142 Atl. (2d) 342, a Pennsylvania case decided June 11, 1958 was an action against the City of Pittsburgh and Allegheny County for personal injuries sustained by plaintiff when he slipped and fell while descending stairs in the City-County Building.

Loeb was serving as a juror in the Common Pleas Court in the City-County building, at the time. At 11:30, he was excused for lunch. Since the elevators were crowded, he decided to walk down the stairs. As he walked down the stairs between the sixth and fifth floors, he slipped on a step and fell. After falling, he turned his head and saw a skid mark on the step on which he had slipped. His heel had slipped on a small spot of colorless liquid on the step. There was no evidence as to the nature of the liquid, how long it had been on the step, or who had placed it there. At the time of the accident, ceiling lights were on at the fifth and sixth floor landings, but they did not cast light directly on the steps. The walls and hand-rail cast shadows across the steps. A wall light which would have cast light directly on the step on which Loeb fell was off at the time of the accident, and although a window was nearby, very little light came through since the day was dark. Loeb did not notice the liquid or that the wall light was out until after he fell. He could see the steps and proceeded with care.

Loeb's contention was that there was sufficient evidence of the City's negligence to require submission of the case to the jury. It was held by the court, however, and affirmed on appeal, that the City was not shown to be responsible for the presence of the liquid and did not have notice of its presence. Therefore, the City (and County) were not liable for

the injury sustained by the defendant.

The fact that the light was out was not regarded as significant since this was not the proximate cause of the injury.

A Catchall Case

Schwartau v. Miesmer, 142 Atl (2d) 675, a New Jersey case decided June 3, 1958, was an action against the Borough of Closter, N. J., for personal injuries sustained when Schwartau fell into a catch basin of a storm sewer.

Miesmer was the owner of property located on the southwest corner of Columbus Ave. in Closter, where he resided. In 1930, the Borough of Closter constructed a storm water sewer in Columbus Ave., and constructed a catch basin in Eckerson Ave. at the southwest corner of the intersection, about 12 ft. from the westerly curb of Columbus Ave. There is concrete paving and a concrete curb at this corner, and the concrete curbing extended to the catch basin. A metal grating was placed over the catch basin, level with the pavement of the street. Grass covered the surface of the ground inside the curb line.

Schwartau's home was located at the northeast corner of the intersection, diagonally across from the Miesmer residence.

On the evening of July 10, 1956, Schwartau had been a social guest at Miesmer's house and, on the way home (sometime between 9 and 10 P.M.) fell into the catch basin. He sued Miesmer and the Borough of Closter.

At the trial, evidence was given to show that the catch basin had been damaged in 1951 by a contractor employed by Miesmer. The damage occurred while the contractor was operating a bulldozer at the time of the construction of the Miesmer home. Miesmer reported the damage to the police de-

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ROUGH GRADES for curbs, gutters; finish grades shoulders, sidewalks, between forms; cuts and cleans drainage ditches; removes weeds and brush. Available with optional leaning front wheels, power circle turn, hydraulic scarifier, hydraulic shiftable moldboard.

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**Look ahead...move ahead
...and stay ahead with**

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THOROSEAL

Restored this Filtration Plant



BEFORE

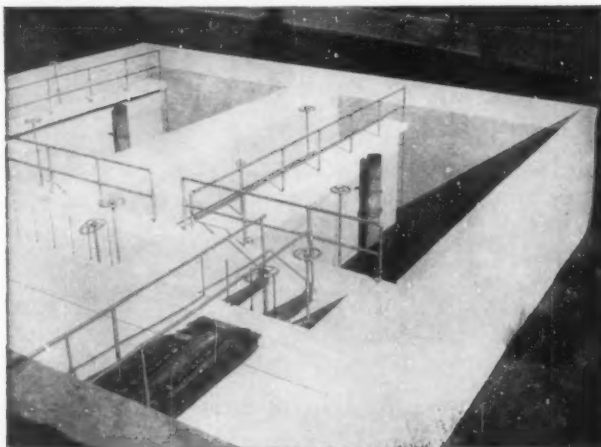
Example of complete break-down of masonry, due to penetration of water into body of concrete and action of frost in damp masonry.



It is amazing how THORO System products will correct a condition, such as shown in photograph. Concrete was sandblasted to remove all disintegrated material to sound concrete surface and reinforcing rods. Patching was done with THORITE Patching Mortar, bringing blistered areas to true and even lines, followed by two applications of WHITE THOROSEAL for protection.

AFTER

At minimum cost, almost 1/3 the cost of other methods, concrete restoration, patching and surface protection was completed with THORO System products on Filtration Plant in Keyser, West Virginia. Contractor: Standard Construction & Waterproofing Company, of Cumberland, Maryland.



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NEW EAGLE, PENNSYLVANIA



partment. Several months later, the borough placed a new wooden cover fitted over the catch basin opening. Testimony of an expert witness indicated that this was an improper repair, as cast iron should have been used.

The court concluded that the fitted wooden cover, with the passage of time, became overspread with dirt, grass grew on it, and the wood rotted, thus causing Schwartau's injury.

It was held that the municipality was liable for negligence in a non-proprietary activity, and the jury verdict of \$25,000 was upheld on appeal.

Sand in Storm Drains

City of Meridian v. Bryant, 100 So. (2d) 860, a Mississippi case decided March 10, 1958, held that where land was located on a street that was protected by storm drains which collected surface waters flowing down the street and carried them away, and the City filled street ruts with sand which washed down and obstructed drain openings causing water to flow on a nearby owner's land and damage their house and garden, the City was liable for the damages for its refusal to correct the condition.

A verdict of \$633 for the home owner was therefore upheld.

• • •

City and Adjoining Districts Cooperate for Water and Sanitation

Operating and staff services for water and sanitary districts in the area around Milpitas, Calif., are provided, under agreements by that city. These special services are on a cost basis and include operation of a primary-secondary sewage treatment plant and a water distribution system. The districts reimburse the city each month for the cost of materials and supplies, rental of equipment, personal services, and overhead. At the end of each fiscal year an independent audit is made by an auditor selected by both parties. A year-end adjustment is then made on the basis of the final cost figures as shown by the audit. The city submits periodic financial reports to the special districts and carries liability insurance protecting all parties. The agreements protect all powers of the districts relating to legislative functions, setting rates or charges, adoption of budgets, establishment of tax rates, legal and engineering services, ownership of property, and purchase of equipment.

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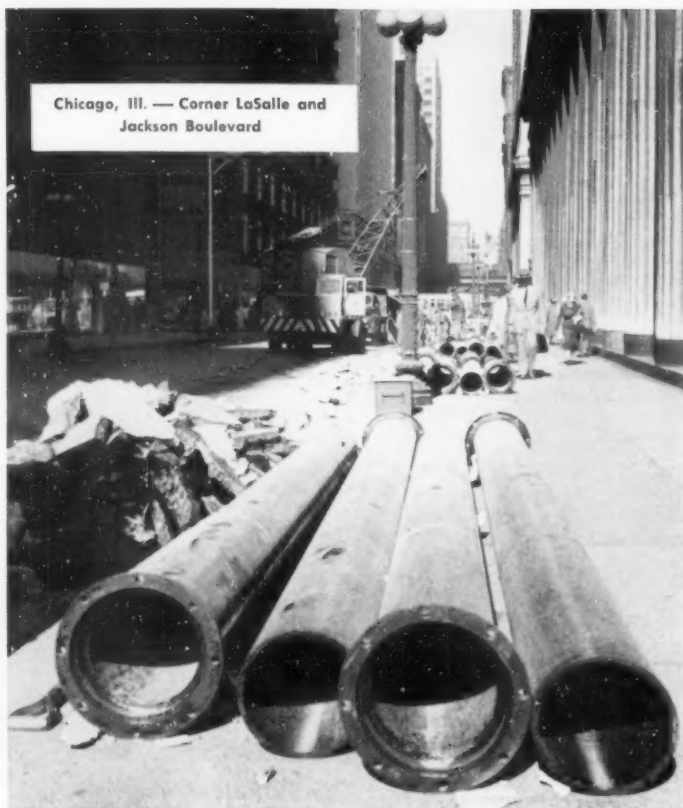
Weldforged LIGHTING STANDARD DIVISION

KERRIGAN IRON WORKS, INC.

Nashville, Tennessee



Water Utilities in Many Cities "DO IT NOW!"



The timely "Do It Now!" program, launched last April by the AWWA to encourage communities to correct basic deficiencies in their water systems and provide for vastly increased future water demands, is making headway fast.

Results of an AWWA survey show that many cities are now speeding up scheduled water works improvements projects, while others are blue-printing deferred plans. They are "doing it now" because they recognize that failure to provide an adequate water system can endanger public health and halt community progress.

When you "Do It Now" in your community, make sure that you don't have to dig up your water mains and "Do It Again" 10, 15 or 25 years from now.

Be sure to specify permanent

CAST IRON PIPE

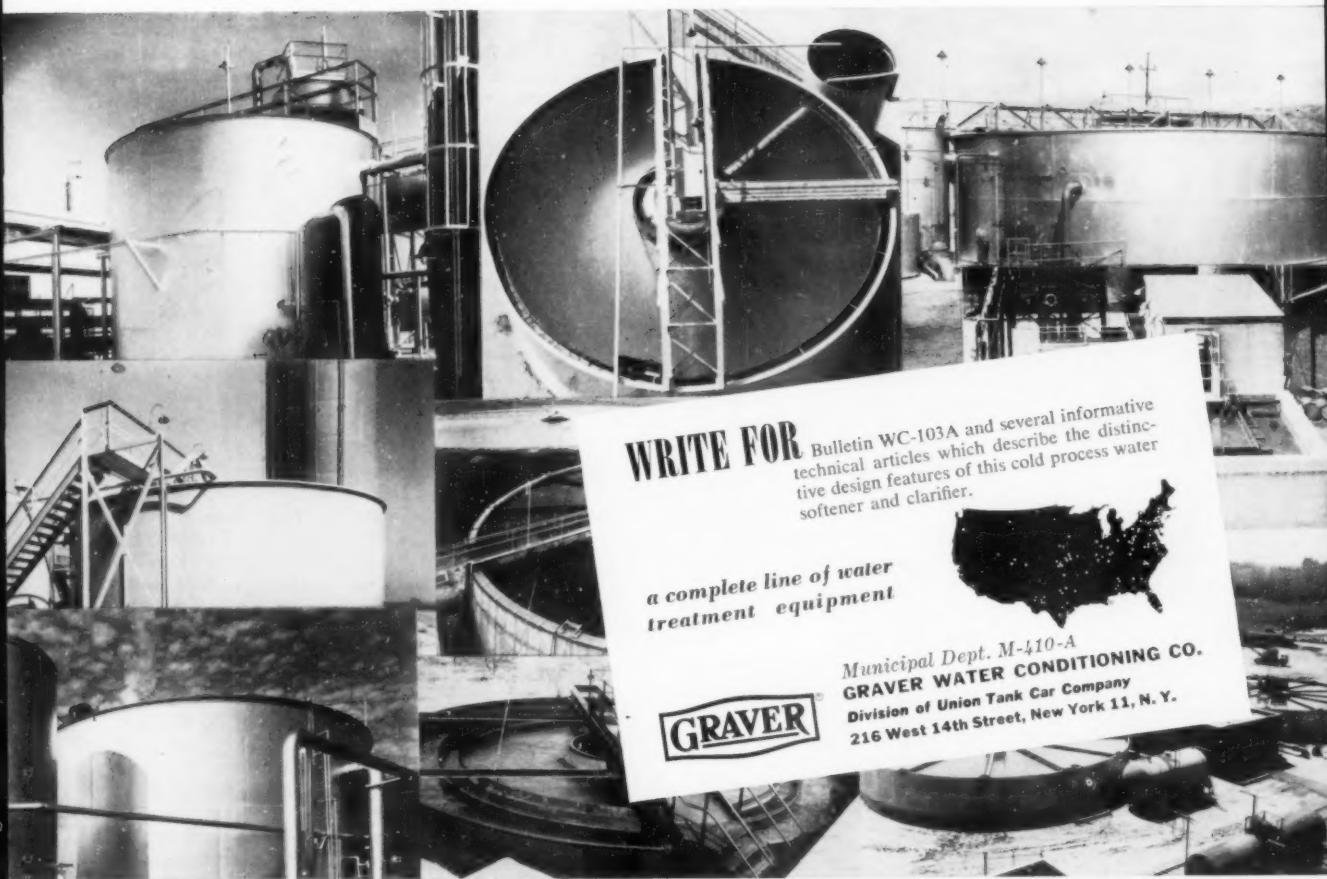
The *proved* useful life of Cast Iron Pipe is at least double the estimated life of other pipe materials used for underground mains. Its maintenance cost is far below that of any other pipe material which has been in use long enough for the recording of conclusive data. That is why Cast Iron Pipe is rightly known as "America's No. 1 Tax Saver."

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NATIONWIDE HIGH-RATE WATER TREATMENT



WRITE FOR

Bulletin WC-103A and several informative technical articles which describe the distinctive design features of this cold process water softener and clarifier.

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Trenching and excavating need not hold up schedules when you have a HOPTO. Model 200 HOPTO has a fast, smooth cycle, a 200° uninterrupted swing, and a digging capacity and ease of operation that knows no equal in its size and class range! Trenching or 'square-cornered digging' is simply handled by 180° wrist action of bucket.

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Please send me complete specifications on the models most frequently used in my field.

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COMMENTARY on WATER and SEWAGE TREATMENT

Sludge Digestion Capacities

R. S. RANKIN

Consultant, Water and Sewage Treatment

IS "HIGH-RATE" digestion of sewage solids an advance in treatment practice which is likely to replace conventional or "standard" methods? Has the process of anaerobic treatment been accelerated to such a degree that existing yardsticks are obsolete? Such conclusions might be reached by readers of technical articles during the past three or four years. If the results of laboratory, pilot, and some full-scale plants are accepted, they seem sufficient to justify a substantial reduction in capacity and hence the cost of sludge digestion. Since some 25 to 40 percent of treatment plant costs now go into this process, any means of reducing them should be most welcome. However, it seems appropriate to analyze various factors which should be considered in applying these results.

In recent years, research has proved what has been long suspected that the efficiency of the typical digestion plant could be greatly improved by more efficient mixing, more frequent feeding and by separating the active digestion step from that of solids concentration. Results have shown that by applying these improved methods digestion proper can be carried to 85 to 90 percent completion in 6 to 10 days as measured by volatile solids reduction. The term "high-rate digestion" then might better be described as "high efficiency digestion" for so far improvements are due primarily to increased efficiency in the process.

Assume for discussion that sludge can be digested in 10 days and that a new plant is to be designed to take advantage of this advance: First, someone must decide on the design load and the future date, ten to twenty years hence, when it will be attained. Next, allowance must be made for variations in the load which may be 150 percent of the annual average for an entire month and for a 10-day interval as much as 200 percent of the annual average. Thus to assure the assumed 10-day detention at all times a 20-day detention based on the annual average will be necessary. It might be argued that during peak intervals detentions can be reduced below 10 days or in this example to 5 days. This would impose an undue and unnecessary burden on an operator who has many duties besides nursing a digester through critical periods.

Again it can be argued that it has been demonstrated that a detention of 10 days is in use in existing plants and is therefore not visionary. While this is true, investigation will show that where this schedule is maintained it is limited to large plants with skilled technical supervision and with ample

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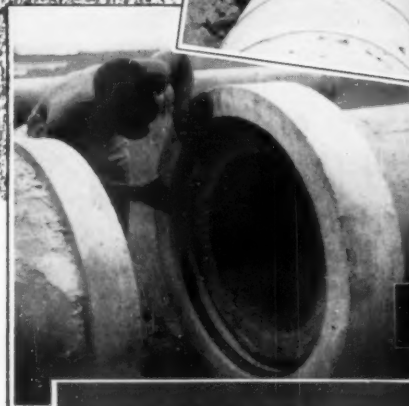
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In America, and all over the world, engineers and contractors call on TYLOX flexible RUBBER GASKETS to prevent infiltration at pipe joints . . . to eliminate costly trench-work delays and speed pipe-laying . . . to defeat corrosion and insure water-tight, maintenance-free joints for the "life of the pipe itself". That's why TYLOX Gaskets were specified for the big pipe projects shown here . . . why they are specified for most waste disposal projects . . . everywhere!

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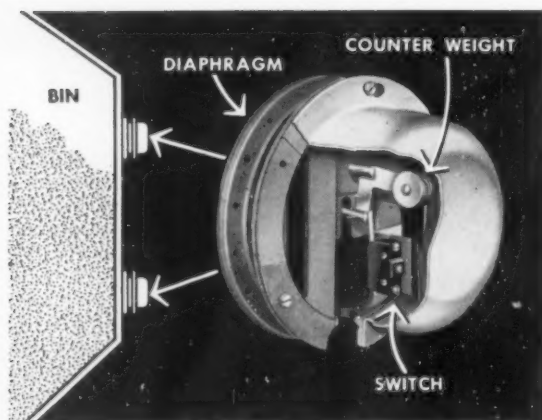
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standby capacity should anything go wrong. Total digester capacity available is usually many times the 10 days.

Another factor to be considered in a new plant is the starting-up period and the attendant problems. Unless digested sludge is available, an interval of 20 to 30 days or often more is required to establish digestion. Of course, the plant may be bypassed or operated intermittently during this period but this is certainly not a desirable practice. When good digestion is established the loading can be increased gradually to full load but even then there can be occasional upsets. Some capacity should be reserved for these conditions and for future unexpected growth.

Other important objectives of good digestion which should not be overlooked are grease reduction and reduction of pathogens. Tests have shown that digestion of grease proceeds at a slower rate than other volatile matter and upwards of 20 days is necessary to obtain a 70 percent reduction. Since the grease content adversely affects the humus value of digested sludge, it is obviously important to have this content at a minimum, particularly when the sludge is applied to the soil. Likewise tests have also shown that survival rate of certain species of pathogenic organisms is greatly reduced after 20 days compared to 6 days. This is also of importance in land applications.

In this discussion digestion tank capacity or loading has been expressed in terms of detention time or tank volume divided by daily volume of feed. However, expressions used in loading digesters vary. Some use pounds of volatile solids per day (or month) per cu. ft. of digester volume; some use detention time in days; and some use a combination. Over 10 years ago the writer presented data advocating the use of detention time as a measure of the progress of digestion. The data were obtained from longtime records of well operated plants and it has been confirmed since in numerous plants. However, mixing of the contents to produce a truly homogeneous mixture did not exist in those plants. With the advent in recent years of thorough mixing, it is only natural that digestion efficiency should be improved. Someone has estimated that displacement efficiency in those older plants was on the order of 30 to 35 percent whereas with current mixing facilities the volumetric efficiency is doubled according to best estimates. What formerly took 30 days to accomplish in reducing volatile solids may now be done in 15 days which is fine providing there are no interruptions in mixing operations.

Where digester loadings are expressed on the basis of pounds of volatile or total solids added per unit of volume per unit of time, a complete picture is possible only when the moisture content of the sludge is included. For example, assuming a unit loading of 0.2 lb. of volatile solids and 0.3 lb. total solids per cu. ft. of digester capacity, at 5 percent solids the detention will be 10.4 days, whereas at 10 percent solids the detention will be 20.8 days resulting in a considerable increase in the volatile solids reduction. The detention time is important regardless of other units used to express loadings. Thickening ahead of digestion is one way to insure maximum feed concentration and maximum detention time.

A primary digester with thoroughly mixed contents is seldom followed by facilities for continuous disposal but since displacement is essentially con-

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The new SR Clarifier makes a **THREE** product separation of sewage. One, it rapidly removes fresh sludge from the floor of the final Clarifier through special vertical withdrawal pipes affixed to a partially submerged trough at the top of the tank. Two, it provides for positive removal of fine silt and other inorganic solids by continuous and positive scraping action to a center sump. Three, it provides for normal effluent overflow over the outside weir.

Advantages of the new SR over *all* competitive units are the positive visual evidence of sludge removal and the separate removal of inorganic solids by continuous raking movements which deposit solids in a central sump from where it is pumped periodically.

For more complete information on the new SR Clarifier for rapid sludge removal write for Bulletin 6193 to Dorr-Oliver Incorporated, Havemeyer Lane, Stamford, Connecticut.



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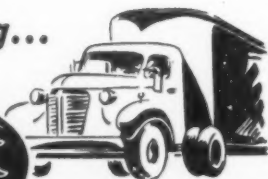
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**Rotates from Left to Right Hand
Plowing Position IN 15 SECONDS**



On runways and thruways, modern time tables depend on fast, efficient snow removal. The Frink Roll-Over Sno-Plow fills this need . . . works full plowing time because it can be reversed from left to right position in 15 seconds! No deadheading! Hydraulic controls in the cab quickly reverse the plow to throw all the snow in the direction dictated by the wind and disposal area location. On dual highways, the Roll-Over can discharge left, yet travel with the traffic.

This unique plow, with curved, tapered moldboard, operates safely at high speed . . . throws and spreads snow to eliminate high banks and subsequent drifting. And when the job is done, quickly and economically, the Roll-Over parks upright within its truck's width. For full details, write to Frink for catalog.

Other dependable Frink Sno-Plows (V-Type; One-Way and Reversible) can all be attached to the Roll-Over's lifting device assembly.

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**FRINK
SNO-PLOWS**

**Clayton, 1000 Islands, N. Y.
Frink Sno-Plows of Canada, Ltd., Toronto, Ontario**

tinuous a secondary or holding tank is required to retain the digested sludge ahead of ultimate disposal. Where sludge has not been prethickened, this tank also serves to separate the supernatant. In any case, it is usually desirable and often more economical to make this secondary unit the same size as the primary digester.

Considering the various factors involved, such as starting up problems, seasonal load variations and the fact that the operator in the average plant must divide his attention among many duties, it seems sound to design the primary digester for a detention of 20 to 25 days based on the average annual loading. With efficient mixing and thickened sludge feed, the plant can obtain the benefit of the recent developments in accelerated or high rate digestion and still have a margin for unexpected conditions. The capacity thus provided, including the secondary or holding tank, should be less than half the conventional installation and the cost materially reduced.

A word of caution is advisable. Reductions in digester capacities below those stipulated by the regulatory agencies may be resisted or approved conditionally. However, it seems inevitable that the prevailing capacity yardstick, cu. ft. per capita, introduced nearly 50 years ago must eventually be replaced by hydraulic and organic load units as in other plant elements. The regulatory agencies have had ample opportunity to observe progress in this field and it is inconceivable that they should continue to resist such beneficial changes.

• • •

Head Loss Due to Friction in 36" Cement Lined Cast Iron Pipe

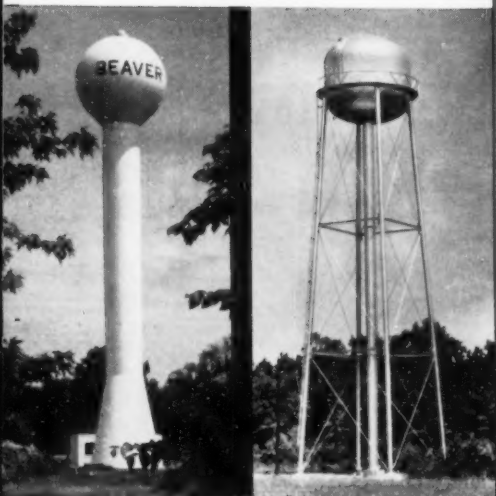
The Chicago North District Engineers made a friction flow test on a 36 in. cement-lined cast iron feeder main in Wabansia Avenue between Cicero Avenue and Mayfield Avenue, over a distance of 7,200 feet. One such test was made on August 29th and two on September 25th, 1957. The tests were made with Mercury U-tubes and pitometers to measure rate of flow. At a velocity of about 2.8 feet per second or 12.8 mgd in the 36 in. pipe, the tests indicated an average value for "C" of 141 in the Williams-Hazen formula. This value of 141 is a very conservative evaluation. Supplementary friction flow tests disclose even higher values for "C". Similar tests made in 1946 gave the value of "C" at that time at 141.

Cars with Automatic Transmissions

Richmond, Virginia, police will use cars with automatic transmissions from now on. This will save the city money because cheaper service will result from constant car use, the large number of drivers assigned to the same car and long hours of slow driving.

The decision to use automatic transmissions in police cars is based on a study of more than 800,000 miles of travel by 32 city cars, half with automatic shift and half with standard shift. Those shifting automatically cost 4.5 cents a mile while those with the conventional shift cost 5.9 cents. This applied to eight-cylinder cars.

Six-cylinder cars, on the other hand, used more gas with automatic shift than with conventional shift, the study revealed. The straight shift will be used on six-cylinder cars used by nonpolice city employees, according to Richmond plans. This data appeared in American Road Builder.



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25,000 gallons

HANOVER, VIRGINIA
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How you can keep ahead of severe winter storms —with Sterling Rock Salt

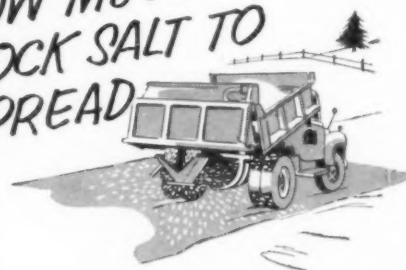
ADVANCE PLANNING



First, be in contact with a weather service, so you know when storms are coming. *Second*, have your equipment spotted around your territory, loaded with straight Sterling Rock Salt and ready to go. *Third*, keep Sterling Rock Salt stockpiled at strategic locations. That way, you can spread rock salt early, before traffic gets tied up.

A generally accepted rate of application of straight Sterling Rock Salt for an average winter storm is 500 lbs. per mile of two-lane highway. At this rate, a truck that holds four tons of rock salt covers 16 miles before reloading. In a storm of major intensity in which snow has accumulated before crews have been able to spread rock salt, it may be desirable to plow to within $\frac{1}{4}$ to $\frac{1}{2}$ inch of the pavement and spread straight rock salt at the same time.

HOW MUCH ROCK SALT TO SPREAD



MORE SALT AS TEMPERATURE DROPS

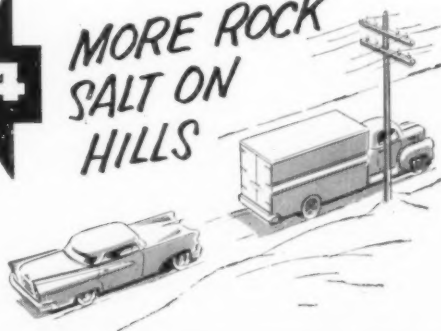


Straight Sterling Rock Salt has effective melting power at temperatures ranging to below zero! All that's necessary is to *increase* the amount of salt used as the temperature drops—just as it's necessary to use more fuel to heat your home when it gets colder outside. Many communities use about $\frac{1}{3}$ more Sterling Rock Salt when the temperature falls below 20° F. (About 650 lbs. per two-lane mile.)

Because steep grades constitute a major traffic hazard, it is sound practice to double the quantity of rock salt applied. This gives bare pavements more rapidly, and provides better traction *immediately*. Grades of up to 19% have been made clear and safe just by using more straight Sterling Rock Salt. Make this point clear to your crews!



MORE ROCK SALT ON HILLS



FREE "BARE PAVEMENT MAINTENANCE" BOOKLET. Ask your Sterling representative, or write for your copy soon. It's an up-to-date, comprehensive guidebook on all aspects of ice control. Can be really helpful in your winter program . . . whether it's municipal, county or state.

INTERNATIONAL SALT COMPANY, INC., SCRANTON 2, PA.

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INTERNATIONAL SALT COMPANY, INC.

MAINTENANCE OF COUNTY ROADS



● ROLLING is an essential element in all types of surfacings. Orange County has 216 miles of 18 to 24-ft. wide pavements.

MOUNTAINS, river valleys, flat lands and a black dirt area known as the onion and trucking lands, are the types of terrain the 216 miles of Orange County Roads wind their way over. Traffic volume ranges from some 350 vehicles per day in the sparsely populated farm areas to about 4,500 vehicles per day in the heavily populated commercial and residential areas.

About 46 miles of the present County Road system were originally constructed with concrete pavement during the period from 1923 to 1935. Since that time, 6 miles of the oldest concrete roads have been reconstructed with improved alignment and grade and surfaced with a road mix macadam pavement, and 29 miles of concrete pavement have been resurfaced with a 2-inch course of bituminous concrete. Where the original pavement was less than 20 feet wide, pavement widths were increased prior to the resurfacing.

The present mileage of 216 is made up of 12 miles of concrete pavement, 29 miles of bituminous concrete on cement concrete base, 17 miles of bituminous concrete on bituminous macadam base, 44 miles of penetration macadam, 107 miles of

EARL DICKERSON,

Orange County Superintendent,

Goshen, New York

road mix macadam and 7 miles of bituminous double surface treatment. Widths of pavement vary from 18 feet to 24 feet. This mileage is being increased by new construction on roads taken over from the Town systems at the rate of 6 to 7 miles each year.

Personnel

For purposes of control and supervision of maintenance of County roads, the County is divided into three maintenance districts. Each district is provided with a maintenance building centrally located with respect to the approximately 70 miles of road in the district. Personnel include a district foreman and 7 men, and regularly assigned equipment includes one 2½-ton dump truck, one pickup truck and one tractor-mower, together with small tools and equipment required for maintenance work. Additional

equipment, when required, is assigned temporarily from the central highway garage.

The work performed by this personnel includes the routine maintenance operations such as patching; cleaning culverts and ditches and repairing shoulders; mowing and cutting weeds and brush; removing dead and fallen trees; replacing guide posts; cleaning up rubbish and debris; and other miscellaneous work as required. Annual costs of these operations on County roads are broken down approximately as follows: Patching—\$25,000; cleaning culverts, ditches and repairing shoulders—\$30,000; mowing, cutting weeds and brush and removing trees—\$35,000; repair and replacing guide posts—\$5,000; and cleaning up rubbish and debris scattered by the traveling public along the roads—\$3,000.

In addition to the work performed by the district foreman, special maintenance work is accomplished by two floating crews operating throughout the entire County. This work, which is scheduled on the basis of periodic inspections of supervisory personnel and requests and recommendations from the district foremen, includes cutting of



● SURFACE treatments are normally applied each three years and involve 40 to 50 miles of road per year. Approximate cost per mile in 1958 was \$970 or 9.2¢ psy.

shoulders and ditches; surface treatment of pavements; painting traffic lines; painting guide rail and posts; chemical control of weeds and brush; repair and replacement of signs and repair and maintenance of County bridges.

The cutting of shoulders and ditches is considered to be the most vital phase of maintenance in prolonging the life of the pavement. The experience of this Department indicates that keeping shoulders cut down flush with the pavement surface to permit rapid surface runoff and keeping ditches cut to a depth which will provide adequate drainage of the sub-base eliminates the cause of a great deal of deterioration and consequent breaking up of the pavement. Since normally this operation is required every 5 or 6 years, we have been doing approximately 40 miles of road each year. In 1958, 40.18 miles were completed at an average cost of \$180 per mile of road. The work is accomplished with two Austin-Western graders, one Athey loader and as many 5 to 7-yard dump trucks as may be required to dispose of the material as rapidly as it is removed. One grader cuts, slopes and clears out ditches, bringing the material out to the shoulder. The second grader, following closely behind the first, windrows the material along the pavement where it is picked up and loaded with the loader. Weather conditions will materially affect the speed and efficiency of this operation since very wet weather will result in graders becoming mired in the mud and very dry weather will cause a hazardous and disagreeable dust condition. Under good

working conditions two miles of road can be completed each day.

Surface Treatment

The second most important phase of maintenance involving pavement condition is the surface treatment. To prevent the development of surface cracks and resulting porous condition, bituminous penetration and road mix pavements normally require surface treating once every three years. Bituminous concrete surfaces may not require treatment for the first 8 to 10 years after construction, but thereafter will require surface treatment on approximately the same time schedule as other bituminous pavements.

To maintain this schedule, 40 to 50 miles of road are surfaced treated each year at an average cost in 1958, of \$970 per mile, or approximately \$0.092 psy or \$0.33 per gallon. Bituminous material used is either New York State Department of Public Works Specification RT7 and RT8 or emulsified rubber asphalt, applied with distributors furnished and operated by the material supplier at a rate of from 0.25 gallon to 0.30 gallon psy. Cover material of either #1A crushed stone or 1/4 to 1/2-in. washed gravel is spread at an average rate of 15 lbs. psy from a dump truck with a Model DD, Highway Equipment Co., rotary spreader mounted on the truck tail gate. Material is spread the full width of the pavement in one operation. The mechanical spreader is transferred from one truck to the next as each load is backed into position, with an extra spreader kept immediately available for use in case of mechanical failure. After

cover material is spread, it is thoroughly rolled with an 8-ton Galion roller. Personnel required, in addition to truck drivers and roller operator, include a foreman and 7 men. Cover material is hauled directly from a commercial plant and the number of trucks required will vary with the hauling distance. 8,000 to 10,000 gallons of material are applied, covered and rolled in a normal day's operation.

Painting of traffic lines has been limited and with a few exceptions, has consisted of single lines only. Personnel required for this operation consists of a foreman and 11 men. Equipment includes one M-B paint machine; one 2 1/2-ton stake body truck that is used to draw the paint machine and carry one medium compressor and a 40-gallon pressure tank; 3 pickup trucks, 2 equipped with a bucket seat attached to the tail gate and adjusted to a position approximately 10-ins. above the pavement; and approximately 800 wood blocks and appropriate warning signs attached to each vehicle. One pickup truck precedes the paint truck to warn approaching traffic, one pickup is used to set out blocks immediately behind the paint machine and the third to recover the blocks. In 1958, 112 miles of road were striped, using an average of 6.5 gallons of paint per mile at a total cost of \$28.26 per mile of road.

Weed and Brush Control

Chemical control of weeds and brush has been carried on for the past 4 years, the first 2 years by contract with commercial spraying organizations and the past 2 years by County personnel and equipment. During that period, a great deal of heavy brush has been eliminated from the road sides and recent effort has been concentrated on the elimination of obnoxious weeds and poison ivy. By using reasonable care and selection in the spraying operations, comparatively little trouble has been encountered in regard to damage to crops and residential landscaping.

Spraying material consists of 2, 4-D and 2, 4, 5-T mixed in the proportion of 2 1/2 quarts of chemical to 100 gallons of water. Equipment includes a 2 1/2-ton stake body truck (the same truck used for traffic line painting), one 300-gallon tank, one John Bean double action pump and one Bean spray gun. The spraying is accomplished by a driver and one spray operator, moving at an average rate of 4 mph. During 1958, the condition of most of the roads was



● **CUTTING** shoulders and ditches is a vital phase in prolonging the life of the surfacing. Shoulders must be kept flush with the pavement surface and ditches clean.

such that intermittent rather than continuous spraying was required and 80.77 miles were covered at an average cost of \$18.80 per mile.

Traffic control signs are made up in our own shop with a Minnesota Mining Co. vacuum applicator, using Scotchlite faces on aluminum backing. The preparation of new signs and the repair and replacement of old signs is accomplished by one man on a part-time basis. The total cost of new signs, including materials, labor and depreciation of equipment, averages from \$2.50 to \$3.00 less than the purchase price of ready made signs of the same quality.

The problem of loss of signs due to vandalism, as well as the problem of rubbish dumped along the roads,

is one to which we have not yet found a satisfactory solution. A study made in one maintenance district of 65 miles revealed an annual loss of approximately \$1,000 due to sign vandalism alone, and about an equal cost for cleaning up rubbish. I believe if this problem could be given more publicity than it has in the past, the general public, many of whom are directly responsible for the condition, might become more aware of this annual waste and destruction of public property.

Bridge Maintenance

Bridges maintained by Orange County include 125 bridges located on the County road system and 30 County bridges located on Town roads. Maintenance and repair of

these bridges is carried on by a special crew consisting of a foreman and 8 to 10 men whose time is occupied exclusively with construction and maintenance of bridges. Approximately \$10,000 is spent each year for repair and maintenance of County bridges.

The total cost of all maintenance on County Roads, exclusive of snow and ice control, averages at present about \$850 per mile. With the added mileage of new construction completed each year, maintenance costs become a continually larger proportion of the total highway budget. In addition to a continuous effort to devise new and more efficient methods for performing maintenance work, considerable thought is being given to improvement in construction standards which might result in more economical maintenance in the future. During the past two years, standards have been revised to provide for a better quality of sub-base and pavement materials, more detailed attention to drainage including more extensive use of stabilized ditches, and flatter and more uniform cut and fill slopes, all of which may be expected to effect a reduction in the most costly phases of maintenance operations.

The size of a construction program can be adjusted to some extent to conform with budget limitations, but adequate maintenance of existing roads is essential. A curtailment of this phase of the program, for any appreciable time, in any highway system will result in a road system so badly deteriorated that the cost of a reconstruction program necessary to restore it to a satisfactory condition would be prohibitive.



● **WHEN** bituminous material is applied, it is spread the full width of the pavement in one operation, as shown here.



● **AFTER** ditches have been cleaned and shoulders cut to proper grade, the spoil is hauled away, using 7-yd. trucks.

OPERATION

Heave-Ho!

W. W. COBURN*

City Planning Department,
Ann Arbor, Michigan

THE ABOVE FOUR factors, by no means uncommon in the field of municipal government, combined to bring the comparatively new and badly needed technique of records management to our City. The following is a description of the way we solved our pressing records problem—our procedures, the results obtained, and the cost.

Early in December, 1957, the City Administrator asked the writer, because of his prior experience in the field of records management, to outline a records program for the City and draw up a proposed budget to be presented to the Council for a special appropriation. This was done, and three weeks later the Council unanimously appropriated \$900 from a Contingency Fund to finance the program, exclusive of the records inventory which would be made and financed by the various departments.

Departmental Inventory

This Council action was immediately followed by a memorandum from the City Administrator to all of the 16 City departments and offices outlining the problem and the proposed solution and requesting their cooperation and assistance. The writer then personally contacted department heads and supervisors to answer questions concerning the records inventory each department was required to make. It goes without saying that a complete and detailed inventory of all record material is an essential pre-requisite of any attempt at large-scale, systematic disposal; therefore, it was agreed that such an inventory had to be the first step. During the next

*Mr. Coburn was formerly Records Management Consultant of the Michigan Municipal League and, prior to that, was on the staff of the Michigan State Records Center in Lansing. He wrote his Master's thesis on records management while attending the University of Michigan Graduate School of Public Administration.

One: The City Hall of Ann Arbor, Michigan, is old and very crowded.

Two: There were literally tons of old, useless records occupying extremely valuable cabinet, shelf, and floor space in various parts of the building.

Three: Reference to important material was often difficult if not impossible. Efficiency was sometimes impaired.

Four: The State of Michigan has a statute which reads, in part:

"Any record that is required to be kept by a public officer in the discharge of the duties imposed on him by law, or that is a writing required to be filed in a public office, or is a written memorial of a transaction of a public officer made in the discharge of his duty, shall be the property of the people of the State of Michigan, and may not be disposed of, mutilated or destroyed except as provided by law . . ."

two months considerable help was given to departmental personnel engaged in checking and listing by groups and sub-groups the contents of all filing equipment and records storage space, both active and inactive. As was expected, basement and attic areas contained stacks of old, dusty files long since forgotten by the respective departments. These were, of course, listed and the dates of creation were added. Some actually went back more than a hundred years to pre-Civil War days. The oldest, a faded, yellowish assessment roll of Ann Arbor Township, bore the date 1829.

Retention Scheduling

As soon as a departmental inventory was completed, the scheduling process began. At this point it should be explained that there are two ways of disposing of obsolete public records in Michigan—on a one-shot basis and on a recurring basis. The former merely authorizes the immediate destruction of certain groups of files as listed, whereas the latter schedules destruction when the record reaches a given age. One method requires written permission for each separate disposal; the other does not. At no time did we consider anything but the recurring type.

The scheduling process consisted of sitting down around a table with a department head and frequently one or more supervisors and, through discussion, establishing retention periods that were acceptable



● PUTTING the heave in "Operation Heave-Ho." 6½ truck loads were discarded. And there was more still to go.

to all. Each item on the departmental inventory sheet was taken in order. Consideration was given to legal, administrative, reference, and historical values. The obligation to provide the public with detailed information was weighed against operating efficiency and the availability of filing space. In a few instances we found it helpful to refer to the schedules of other cities, but for the vast majority of items the decision was based on our own situation.

After retention periods for all items on the inventory sheet were established, a rough draft of the departmental schedule was submitted to the City Attorney for approval. This gave him more time to review thoroughly each part rather than having to wrestle with the whole 38-page document at once. About 2½ months were de-

ernor and their elected department heads, also approved the schedule without change. At last we had the green light to begin the biggest house cleaning in the history of City Hall.

Each department promptly received a copy of its own officially approved schedule with an attached memo of instructions for putting it

junk yard to be sold and to the City Dump for burning. It totaled 6½ truck loads; 23,095 pounds or more than 11½ tons of paper were discarded; 10 tons were sold and 1½ tons were burned. These records would have filled 456 letter-size filing drawers if all had been stored in such equipment. And there is still more to go.



● **CLERK'S VAULT** before clean-up and disposal had a look familiar to many municipal (and also engineering) offices.



● **AFTER** heave-ho: Not beautiful, but certainly a better place to find things and a great deal less of a fire hazard.

voted to compiling schedules for all departments and obtaining the Attorney's approval. The various schedules were then multilithed and assembled in booklet form, with a table of contents and an attractively designed cover, for final presentation to the City Council and the required State agencies.

Council and State Approval

Copies of the schedule were distributed to the Mayor and ten Councilmen a week before it was to be considered. The City Administrator, City Attorney, several department heads, and the writer were, of course, present at the meeting to answer questions. After a brief discussion, the schedule was unanimously adopted with no changes.

The required number of copies were then submitted to the Michigan Historical Commission in Lansing. Vernon L. Beal of the Commission's staff visited our City to inspect our records and discuss the relatively small percentage that appeared to have historical value. As it turned out, all historically valuable material had been scheduled for permanent retention; therefore no changes were necessary.

Three weeks later the State Administrative Board, composed of the Governor and Lieutenant Gov-

into immediate effect. Instructions regarding packing, collection, and destruction of disposable records were included. During the next five weeks the departments weeded out their office files and dead storage areas and boxed and/or bundled the material to be destroyed. Items of a confidential nature, such as cancelled payroll checks; redeemed bonds and paid coupons; old personal property tax statements; obsolete voter registrations; etc., were labeled in red "destroy by burning" to prevent the information thereon from being disclosed. The cartons so labeled were kept separate from those containing the routine material to be sold as waste paper. Each department was requested to keep an accurate tally of the number of filing drawers emptied for re-use. If the discarded records were kept on shelves, an estimate was made of the number of drawers they would have filled had they been filed in cabinets.

Disposal

When all departments had finished culling their files and boxing the disposable material, the general collection began. A three-man Department of Public Works crew using a 4-cubic yard dump truck spent 2½ days hauling the mountain of accumulated material to a local

Because of a new law that, not then in effect, the Police Department and the Municipal Court decided to postpone for two months the destruction of 118 drawers of old files. These will add approximately 1½ additional tons and increase the total volume of discarded material to 13 tons or 574 drawers. At a minimum average price of \$70 per 4-drawer cabinet, that much filing equipment would cost the City \$10,080. Prior to the start of the current program the City maintained eleven separate record storage areas. The number has now been reduced to six.

Cost and Savings

The cost of the records program to date—including inventory, scheduling, and disposal—has amounted to \$1,150, of which \$49.85 was recovered through the sale of the waste paper. Of much more importance are the substantial savings in filing cabinets, steel shelving, and floor space that have been cleared for re-use. Many of the departments will not have to purchase filing equipment for several years and due to the recurring nature of the retention schedule, sufficient basement space is now available to take care of the foreseeable future. Fred J. Looker, City Clerk, estimated that paper accumulation in



● RECORDS of possible historical value were checked before disposal by City Clerk and a state representative.

inactive storage areas (basement and attic) had been reduced 75 percent and the volume of office files in the various departments about 20 percent.

In addition, weeding out the old and useless records has made reference to current files easier and faster, thereby increasing operating efficiency and reducing filing costs. Two other important results of our records management program have been the protection and preservation of the City's historically valuable records and the substantial reduction of the ever-present fire-hazard.

Enforcing the Schedule

Starting at once, our records program will have a direct effect on purchasing procedures. To make certain all departments follow the schedule and keep their accumulations of inactive records down to the required minimum, purchase requisitions for additional filing equipment will not be approved until the departmental retention schedule has been spot-checked against the existing files by someone from the Purchasing Section. If disposable material is being retained longer than necessary, it will have to be discarded before the purchase order may be written. This procedure will prevent the accumulation of obsolete and useless records in violation of the schedule.

The values of records change with the years. Because of constantly changing conditions—new procedures, forms, etc.—a retention schedule must be revised periodically.

The permanent record of today may be the disposable record of tomorrow. If a department head or supervisor feels that certain records on his schedule should be kept a longer or a shorter time, he must send a brief memo to that effect to the City Administrator and state his reasons. The same is true for new forms. A memo suggesting a retention period and a sample copy must be submitted whenever a new form is put into use. Periodically, the accumulated list of needed revisions and additions will be forwarded to Lansing for approval by the Historical Commission and the Administrative Board. We have continually stressed the point that no deviation from the current schedule can occur without State approval.

Conclusion

Like any other tool of management, a records retention schedule is only as good as the person using it. If used properly and kept up to date, we know our schedule will give us the following important advantages: 1) Provide a system for keeping paper accumulation to a manageable minimum; 2) save badly needed office and storage space and costly filing equipment; 3) expedite reference to working files

and increase operating efficiency; 4) protect records of administrative and historical value; and 5) reduce the risk of fire in our City Hall.

As cities continue to increase in size and expand their services, the amount of paper work and the volume of files will, of course, increase accordingly. Inevitably city halls will become even more crowded. The banks of filing cabinets and storage cases in offices, vaults, and basements will grow longer and higher. To bring order out of chaos, all cities of any size eventually will have to adopt a records retention and disposal schedule. Although private industry and the federal government have long recognized the value of records management, it is a comparatively new technique in the field of municipal administration. With the adoption of a records retention and disposal schedule, Ann Arbor became the 19th municipality out of a total of 505 in the State of Michigan to install a records program. We recognize records management as an essential technique for alleviating our critical space shortage and improving the internal operations of the various departments. We are well pleased with the results that have been obtained.

FLUORESCENTS REPLACE INCANDESCENTS

THE MAIN intersection in Kutztown, Pa., is lighted by four General Electric fluorescent luminaires which provide a maintained illumination level of 3.5 footcandles. Fourteen other four-lamp fluorescent units have also been installed along Kutztown's main street as the

first step in a long-range relighting program. Luminaires are installed at heights of 25 feet on aluminum poles spaced at staggered intervals of 87 feet. Two-foot brackets position the lighting fixtures at the proper angle over the 36-ft. wide thoroughfare.



SIGNS FOR SAFETY

CHARLES ALEXANDER,
Assistant Traffic Engineer,
Montgomery, Alabama

SAFETY IS no accident—it must be planned. The Traffic Engineer, ever conscious of the needs of traffic safety, has found that one of the most effective safety devices is the judicious use of traffic signs.

For administration, our Traffic Engineering and Electrical Department is composed of three Divisions: Traffic Engineering, Electrical, and Radio Communications. Each of these Divisions is headed by a supervisor directly responsible to the Traffic Engineer.

The Traffic Engineering Division is made up of the Sign Shop, Street Marking, and the Engineering Sections under the supervision of the Assistant Traffic Engineer. The Sign Shop Section is charged with the responsibility of preparation, installation, and maintenance of all signs used by the City. In addition to traffic control signs, all special signs for other Departments and the numbering and lettering on city vehicles and equipment are included.

There is one sign painter who prepares all signs, with the exception of a small number of prepared signs purchased each year. He has a prisoner, when available, to assist in handling signs and clearing up the shop. Because the installation of signs and pavement markings are so closely related, both operations are coordinated under one supervisor. A half-ton pickup truck equipped with a sign rack capable of holding 45 signs of different sizes and manned by a crew of two permanent employees, is utilized.

It is anticipated, in the near future, to equip the sign truck with a two-way radio. This will enable us to communicate with the office, as well as with other city trucks.

The main room or work area of the Sign Shop is approximately 13 feet by 31 feet. In this room is located a cleansing tank, a vacuum applicator, a silk screen table, a drawing table and drying rack which is capable of holding some 1500 signs, depending on the size. The

shop's secondary room, 7 feet by 13 feet, is used to store equipment and supplies.

Due to the limited size of the shop, sign blanks are purchased ready for final treatment. For the most part, 0.064 vapor degreased flat aluminum blanks for signs up to 24 inches x 24 inches are used. We prefer flat aluminum blanks, because they are lighter in weight and are very little affected by weather or vandalism. By using flat, rather than embossed sign blanks, we can use them over again for many different purposes. For exterior signs larger than 24 ins. x 24 ins., we are experimenting with high density overlay plywood. It is still too early to offer any concrete recommendations.

Preparation of Signs

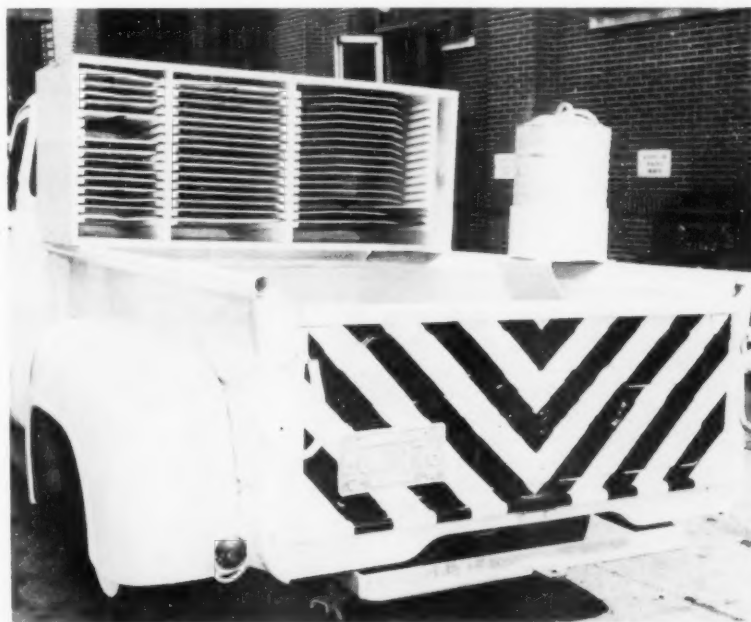
The preparation of signs, using new aluminum blanks, is very simple, as they are degreased and ready for imprinting of copy. However, an inspection is made of each blank, and a coat of varnish type

primer is applied before processing. Raw wood signs are coated with linseed oil and lead zinc paste before the application of finishing enamel. Imprinting is done by the silk screen method. Screens, for commonly used copy, are kept in stock. Special stencils are cut for odd copies. All designing and layout is done in our shop, which enables us to carry a job through from start to finish.

Refinishing old blanks removed from the street is a similar process in that the majority of them simply need to be cleaned and repainted, with an outdoor or weatherproof enamel.

We have a policy of reflectorizing all signs that should be seen at night. This includes speed, stop, yield, one-way, etc.,—practically all with the exception of some parking signs. There are several methods of reflectorization: Reflector buttons, reflective coatings or reflective sheeting. We prefer reflective sheeting or reflective coatings.

The installation of signs and



● HALF-TON pick-up truck used by Sign Shop Section has special rack holding about 45 signs. Rack construction permits man to stand on top to drive posts.



● SCOTCHLITE being applied to a 24-inch aluminum blank. by a vacuum applicator. Flat blanks are preferred generally.



● CENTER shows how a "stop" sign is mounted on a concrete stanchion. At right is a "Yield" sign on a U-type steel post.

standardization of sizes and shapes is in accordance with the "Manual on Uniform Traffic Control Devices for Streets and Highways", although standardization of position cannot always be attained. As a general rule signs are located on the right side of the roadway. However, we have found placing the sign on the left side in a channelized intersection, or suspending the sign above the pavement is more advantageous under some circumstances.

Normally signs are erected individually on separate posts, except where space is limited, and the addition of signs would supplement another. We use 10 ft. U-Type steel sign posts, mounted in concrete or driven into the ground about three feet. For portable or removable signs concrete stanchions are used, with the average height being from four to five feet.

An ample supply of all signs in general use is maintained and for this reason a monthly inventory is taken of all signs, blanks, posts and materials on hand. Thus, the stock is maintained at a desired level, which enables us to give more efficient service throughout the City.

From an engineering standpoint there are many stop signs in place where a complete stop is not necessary. The sole purpose of these stop signs is to assure that traffic yields the right-of-way. Even if the motorist should yield the right-of-way by slowing down, if he does not come to a complete stop, he will be a law violator. To prevent this and to aid the movement of traffic, the City has replaced many stop signs with 30 in. triangular yield signs.

At locations where stop signs are required the 24 in. all-red sign is used. Again, aluminum blanks with

reflective sheeting applied with the vacuum applicator are used.

At intersections, where yield signs or two-way stop signs are found inadequate to handle the flow of traffic and a traffic signal is not warranted, the four-way stop sign has been found very successful. For this work, we have found that the 24 in. red reflectorized stop sign with the words "four-way" installed at the top and bottom is very effective.

The City of Montgomery was cited, by the National Safety Council, as being the safest city in the United States in our population class in 1957. Although there are many factors that contribute to such a record, we feel that our sign program was a major factor in achieving such a fine outstanding record, of which we are all justly proud and which we are endeavoring to maintain.

STREET LIGHTING MODERNIZATION

WITH MAJOR north-south and east-west highways running through it, the City of Macon, Georgia, has an especially severe problem due to the heavy traffic and the tremendous growth of the city. In an effort to alleviate the parking situation, Mayor B. F. Merritt, Councilman A. Payton, Chairman of the Utilities Committee, and W. M. Parker, Traffic Engineer,

G. A. SPENCE,
City Electrician,
Macon, Georgia

and
W. W. WILDEMAN,
Kerrigan Iron Works, Inc.

made a study to improve the traffic and parking conditions. One street in particular that offered promise for additional parking facilities was

Poplar St., which has a very wide right-of-way from property line to property line. It also had a wide park area in the center which was planted with pecan trees.

The solution was to rearrange this street to provide through traffic lanes, as well as the maximum additional parking areas. It was not the intention to remove the center parkway completely, but only to

reduce the width sufficiently to provide the maximum number of automobile parking spaces. The parking areas are separated from the traffic lanes by a very narrow concrete island.

After the street had been improved, a study was made for lighting this entire area in the best possible and most economical way. The small concrete dividing island appeared ideal for mounting the street lighting standards. All standards on these islands are twin bracket standards with two luminaires. Those mounted on the curb lines are single bracket standards with one luminaire. The entire system is fed underground with a three wire multiple system from the Georgia Power Company lines, through Fisher-Pierce photocell light controls.

Four anchor bolts were used to attach the lighting standards to the concrete and two conduits for the wiring enter through the base. The standard foundations are an integral part of the islands for those mounted thereon.

The handling and installation of the Kerrigan Model 400K-8B-25 twin bracket street lighting standards was no problem to the men doing the installation. Their 1½-ton ladder truck answered the purpose. Only a few standards were carried on the ladder truck to the site of erection from their pole yard. This was decided upon so that no excess material would be lying around the streets creating hazards to pedestrians and autoists. The standards were unloaded at each location just prior to erection with a minimum of traffic interruption and manpower.

Installing Standards

In order to erect the standards in a vertical position without the necessity of using a transit, the anchor bolts were furnished with two nuts. The first, or levelling nut was adjusted and checked by means of a spirit level placed across the nuts. The transformer base was then installed, but before the locking nuts were pulled down tight, the top of the base was checked again with a level.

The method of erecting the standard shaft was quite simple in that the standard ladder truck was used very effectively. The ladder on the truck was extended and directed upward over the side of the truck and over the transformer base then in position. A small double pulley block and tackle lift was fastened to the top of the ladder and the other end fastened with a rope hitch to the standard which was pulled up



● LIGHT standards provide a mounting 28 ft. 2 ins. high for the luminaires which are 40-watt, 20,000-lumen mercury vapor lamps to provide 1.5 fc illumination.

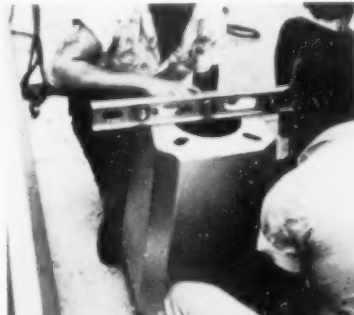
into position for setting on the transformer base. This system of erection did not require special equipment, tools, trucks, booms, etc., but was simple, fast and inexpensive.

To perfect the appearance of the installation, the parkway in the center is grass covered with camellias and rose bushes planted throughout. All of the street lighting standards are designed to provide

a 28-ft. 2-in. mounting height of the luminaries, which are the horizontal 40-watt, 20,000 lumen, mercury vapor lamp type fixture. These are so arranged to produce an average maintained level of illumination slightly less than 1.5-foot candles. Additional modernization of the street lighting in Macon is being installed at present on Cotton Avenue, First Street, and on the River Bridge.



● ANCHOR bolts have two nuts which are checked with a level for accuracy.



● BASE for transformer is then installed and checked again with a level.



● LADDER truck hoists the standard and sets it into position for setting.



● STANDARD in place. No special equipment is needed for installation.

GRANULATED and AIR-COOLED SLAG For Road Construction

J. W. CARLSON,
Assistant Chief Engineer.
Allegheny County,
Pittsburgh, Pa.

THE THREE rivers which pass through Allegheny County, the Monongahela, Allegheny and Ohio, are the source of natural sands and gravels which have been dredged for many years and the supply is seemingly inexhaustible. Many of the surrounding hills contain rock suitable for construction and many pits and quarries have been developed with aggregate crushing plants.

The steel mills on the banks of the rivers are an endless source of supply for reinforcing bars, wire mesh, structural shapes, and plates for all kinds of construction. As a by-product of steel making, blast furnaces pour out a stream of very useful material called slag.

In the reduction of iron ore to pig-iron, large quantities of layered limestone, iron ore and coke are used. This mass is heated in the blast furnace by the introduction of hot air. Finally, the molten iron gravitates to the bottom of the hearth and is drawn off. The remaining dross is hot slag. This hot slag may be hauled from the mill in railroad ladle cars and dumped while still molten, so that it cascades down over the dump in a lava-like stream. It cools to a rock-like mass. Or the hot slag may be directed into a pit or pond of water, located near the furnace and this rapid quenching breaks up the slag into granulated sand-like particles.

The air-cooled slag is processed from the slag dumps by crushing and screening to the sizes required for concrete aggregates for paving or concrete construction. No further processing is necessary for granulated slag; it is merely removed from the granulating pit and hauled to the construction project or temporarily stock piled.

Prior to the recognition of the value of slag in the County, it was hauled from the mills by railroads

and used as fills and embankment materials, and by trucks to dumping grounds in the hollows. The first recorded use of slag for roads in Allegheny County was in 1913, when a slag bituminous road was built. After that time granulated slag was used as a satisfactory fill material back of bridge abutments, critical slide areas and fills where

of either slag aggregate or stone aggregate, with gravel aggregate concrete allowed for structures. Because of price differentials both Portland cement and bituminous pavement are usually constructed of slag coarse aggregate.

Asphalt surfaced road construction consists of rough and fine grading and installation of drainage



● SLAG being placed and compacted on an Allegheny County, Pa., highway. This is a water-bound macadam project and slag is being compacted with a Vibro-Tamper.

the natural soils in the areas were not suitable because of high plasticity.

The extensive use of slag as a construction material for uses other than fill material, began about 25 years ago by Allegheny County. The river front projects on Water Street and Duquesne Way bounding the Golden Triangle were constructed on granulated slag fills, which formed the roadway base. Since 1955, the importance of a granular and porous material, not affected by water, as a base for concrete highways, was fully recognized as necessary if eventual pumping and subsequent deterioration and failure of highway slabs was to be avoided. Since that time a 6-inch layer of compacted granulated slag has been specified as the base for all concrete road construction.

All concrete pavement by Allegheny County is now constructed

facilities and allied work prior to the actual laying down of the roadway. After the roadway has been sub-graded and rolled, a 6-inch compacted thickness of granulated slag is placed and thoroughly wetted and rolled. If time permits, traffic is allowed to run on this base for a period of about two weeks. This has the effect of consolidating the slag to a hard, firm surface and developing any possible soft spots in the subgrade. If such soft spots appear, they are dug out and replaced with better earth material or granulated slag. Number 4 air-cooled slag is then placed on the granulated slag base over a 1-inch layer of slag screening acting as an inverted choke, to a compacted depth of four inches. This is rolled and slag screenings applied in three operations, vibrated, rolled thoroughly, wetted and rolled until a slurry appears ahead of the roller. The second 4-inch layer is then

similarly applied, resulting in an 8-inch water-bound macadam. This second layer is allowed to dry, power broomed and inspected before a hot asphalt surface is applied.



● **BINDER** course of 2-inch bituminous concrete being laid in several passes on a completed water-bound base of slag.

The macadam is considered prepared when the individual particles of No. 4 slag are so imbedded that a repeated effort to kick them out of the bed is necessary to dislodge them.

After sweeping the macadam surface, a light tack coat of liquid bitumen is applied, followed by the placing of Specification "BD" hot asphaltic slag concrete binder to a thickness of approximately two inches, or 200 pounds per square yard. Specification "D" hot asphaltic concrete surface course is finally applied to a thickness of approximately 1½ inches, or 150 pounds per square yard.

The thickness of the completed roadway is therefore 6 inches of granulated slag base, 8 inches of waterbound macadam and 3½ inches of asphaltic concrete pavement, for a total of 17½ inches. Bleeders through the shoulders to the ditches are placed on about 100-foot centers to drain the paved roadway foundation.

The County roads constructed under this specification are able to withstand any legal highway loading and heavy traffic without distortion and with a minimum of maintenance.

Road Widening

In 1957, and again in 1958, a planned program of road widening has been in progress. A number of the old County roads constructed to a 16 and 18-foot cartway width

have become inadequate because of growth to the suburbs and increased volume of traffic. These roads are being graded to the full 33-foot legal width and the cartway widened on each side to obtain a minimum width of 22 feet. This operation follows the grading and consists of cutting a trench adjacent to the existing road edge by a bucket wheel excavator, backhoe or Grad-all to a depth of 11 inches. After the trench base has been rolled, a 6-inch compacted depth of granulated slag is placed, wetted and rolled, followed by a 5-inch compacted layer of air-cooled slag waterbound macadam. This is likewise vibrated and choked with screenings until a solid compact mass is obtained. The surface of the widened portion is slag chip

yd.), \$11.00 per ton. Reduced to cost per square yard, the 2-in. binder course costs \$1.075 and the wearing surface, \$0.733. The 17½ inches of roadway on the project will therefore cost the County \$4.51 per square yard in place. The cost of the road widening, exclusive of the grading, has been \$3.80 per square yard, complete, which includes excavation and disposal.

The equipment necessary for the construction of County roadways includes the usual graders, high lifts, 10-ton rollers, vibrating compactors, slag spreaders, water trucks for the base courses and asphalt placing machine and rollers for the surface courses. A fine slag dust and Portland cement are usually spread and broomed over the completed pavement to fill any small surface holes



● **PLACING** a 2-inch bituminous concrete binder course. The adjacent section of the surfacing has been rolled initially. Base and surface costs are about \$4.50 psy.

sealed using 0.4 gallon of hot bitumen per square yard and rolled even with the existing pavement. A follow up overcoating of the entire roadway surface with hot asphaltic concrete Specification "D" wearing surface is done under a separate contract the following year. However, the overcoating can be done immediately following the road widening if desired.

The cost of furnishing and placing slag aggregate pavement on roadways has been very stable over the past few years. Typical costs, taken from Haymaker Road now under construction, are as follows: Granulated slag base (6-in. thick), \$0.75 sq. yd.; waterbound macadam (8-in. thick), \$1.95 sq. yd.; asphaltic concrete binder course, hot mix, County Specification "BD", (not to exceed 200 lbs. per sq. yd.), \$10.75 per ton; and asphaltic concrete wearing surface, hot mix, County Specification "D", (not to exceed 150 lbs. per sq.

and to absorb any surface asphalt and give a "skin" to the surface. This has proved effective and worthwhile.

The road widening projects require an efficient trencher of the wheel and bucket type, a one-wheel roller and slag distributor in the trench. This technique of road widening has become a specialty with contract crews and rapid progress is being made.

A considerable quantity of granulated slag is also specified and used by the County as compacted fill in pipe trenches crossing roads, because slag filled trenches have little or no settlement.

Slag, both air-cooled and granulated, has become an almost indispensable material in Allegheny County for high quality road construction. Like the Chicago packing houses which are said to use everything but the squeal, there is now no waste product in steel making.

FUNCTIONAL OFFICE FACILITIES

JOHN R. PARKER,
J. Stephen Watkins,
Consulting Engineers,
Lexington, Kentucky

TO OPERATE most efficiently, every engineering firm requires office space of adequate size, laid out functionally and held on a long-term basis. When their rented facilities were again outgrown recently, J. Stephen Watkins, Consulting Engineers, decided to design an office building to meet their own needs. Finally, in May 1958, they moved into a permanent home, a new, company-designed office building, completed at an overall cost (excluding real estate) of approximately \$200,000.

A description of the organization will help to explain their needs and the evolution of the solution. The parent or primary firm is J. Stephen Watkins, Consulting Engineers. Formed recently to practice architectural as well as engineering work is the partnership of Watkins and Mills, Architects and Engineers. The two firms share the same facilities,

and much of the same personnel. In addition, the Watkins Corporation was formed recently to acquire the property, finance, build and rent the new office building to the "using forces." Counting employees in sub-offices and field parties, the firms employ some 200 persons, about half of whom work in the home office.

The firms do not undertake actual construction, limiting themselves to planning, designing, engineering and the usual scope of architect-engineer practice, including engineering supervision of construction. Typical assignments include: surveys, site studies and design of military installations, including several Nike defense installations around large cities; in sanitary work, surveys and preparation of plans and specifications for water and sewerage work in municipalities in several states; in highway work, all aspects of work on major highways and toll roads except the actual accomplishment of construction.

It was determined that the firms needed office space of roughly 17,-

000 square feet, consisting primarily of reception space, a dozen offices, and room for 70-odd drafting tables. Provision also had to be made for numerous related and supporting activities: Administration and accounting offices; library-files-mail room; conference room; reproduction room; storage space; coffee room; vault; toilets; computer room; utilities; and parking space. All these were integrated into the building and its grounds.

Three or four years ago, the rented facilities began to appear inefficient, inconvenient, and so limited in size that the overflow was forced into nearby buildings. Also the parking problem was a constant headache. These conditions led the firm to begin considering actively its own custom-designed building. One of the first steps taken was to acquire suitable property, a tract with a frontage of 228 feet and an average depth of 236 feet.

The location selected is some ten blocks or eight-tenths of a mile from the heart of the city, far enough to be free of the worst con-



● FIRST FLOOR layout of the office building designed by and constructed for a large firm of consulting engineers.

FOR AN ENGINEERING FIRM □ □ □ □



● FRONT of the new building presents an attractive and dignified appearance.

gestion and clamor of the city, and to avoid prohibitively high priced real estate. At the same time, it is close enough in to be reached easily by visitors and employees.

Initially, an outside architect was called in to start the design. Later, as pressure of other work allowed, the firm's own architects and engineers developed their ideas of a desirable and efficient work shop. The final design was the result of the joint efforts of the entire professional staff; this is the outstanding feature of the whole project. Such a common effort was not without many discussions. In fact, there is a saying around the office that this may not be the best designed building of its type in the country, but it certainly is the most designed.

Construction contracts were let in May, 1957, and the building was completed about eleven months later. Only two significant changes or additions were made during the progress of the work: A telephone equipment room was added, and the pressure of an ever-increasing staff led to the decision to finish the basement in a manner similar to the first floor rather than to defer the finish work until needed later. Occupation was completed in April, 1958.

Functional Features

The resulting building is generally agreed to be an excellent solution to the organizations' requirements. Better working conditions have been achieved through convenient layout, good traffic circulation, air conditioning and many other features.

Foundation walls are concrete, outside walls are brick veneer on concrete block, and interior bearing walls are concrete block, plastered and painted. The roof is a flat, built-up type with cut stone coping. Appearance and maintenance are helped by copper flashing and downspouts, slate entrance vestibule floor, marble window sills and vinyl and asphalt tile floors. Hardware and window frames are aluminum, dull satin aluminated.

A combination hot and chilled water system fully copes with the local climate, which is warm and humid in the summer. While provision for the comfort and health, and hence the efficiency, of personnel is the largest benefit from



● SPECIAL room houses the Bendix G-15D electronic computer and cable connected typewriter. Extra cooling capacity is provided for this special room.

year-around air conditioning, additional benefits are realized, such as avoiding smudges on drawings and reducing dust and noise from the outside.

A very flexible, 45-station private telephone exchange was installed, and a 5-station public address system was moved in from the old location.

An 80 by 38-ft. basement houses the mechanical equipment, a fire-proof dead file vault, several storage rooms and a 12-table drafting room. Reproduction, in a thoroughly sound-insulated room, is accomplished by a Verifax copier, an Addressograph-Multigraph (Model 750) multilith for offset reproduction, and a Paragon Revolute for ammonia process blue-line work.

The first floor was laid out to channel traffic through the main entrance, past the reception desk and partitioned administrative and accounting offices, to any one of the eight offices without disturbance to the draftsmen. The main drafting room is the central feature of the 11,000-square foot first floor. An entrance for employees is closer to the areas where the majority of them work, and a double rear door provides for movement of supplies and equipment.

Most of the individual offices allow flexibility in the use of their floor space through job-built movable partitions of natural-finished birch panelling. The offices have individual thermostats, and are placed for the most part just across the corridor from the main drafting room.

The Drafting Room

There is particular pride in the thoroughly functional main drafting room, a prime consideration for any engineering firm. A feeling of open space is due to the absence of interior columns or exposed beams, and the space left open to the ceiling above the five-foot storage-file wall on the side next to the corridor. Coats are hung out of the way in a nearby coat space recessed from the hall.

Ample file and storage space is provided both for the room as a whole and for each of the 60 drafting tables. The tables are so arranged that each draftsman has at

(Continued on page 130)

MINIMIZING TRAFFIC INTERFERENCE

CAUSED BY

UTILITY WORK IN STREETS

SINCE 1924, City Ordinances in San Francisco, have required that sewers and water and gas mains be installed in streets before any permanent paving is laid. By this means interference between street traffic and construction of utility lines is avoided, at least until such time as improvements either below or at pavement level must be made. When it becomes necessary to repair or reconstruct a street, the utility companies and all city departments are notified in advance so that they can plan any desired enlargements or re-arrangements of their facilities. By this means the utility work and street work can both be done at the same time thereby limiting interference with traffic to a minimum period of time.

As the City grows older and land uses change, numerous enlargements or improvements of the underground systems become necessary from time to time, such as the following:

- 1) Sewers must be repaired or enlarged;
- 2) additional or larger gas mains become necessary;
- 3) larger water mains are needed for domestic use or fire fighting;
- 4) telephone and power wires are put underground to improve the appearance of the City;
- 5) additional conduits and wires are needed in underground ducts as business increases; and
- 6) new service lines must be extended into buildings to meet expanding demand.

The general public will recognize the need of these improvements but will expect them to be accomplished with a minimum of inconvenience and annoyance.

Whenever any work in a street is contemplated which will affect the movement of vehicular traffic, the Police Department should be notified in advance giving the following information:

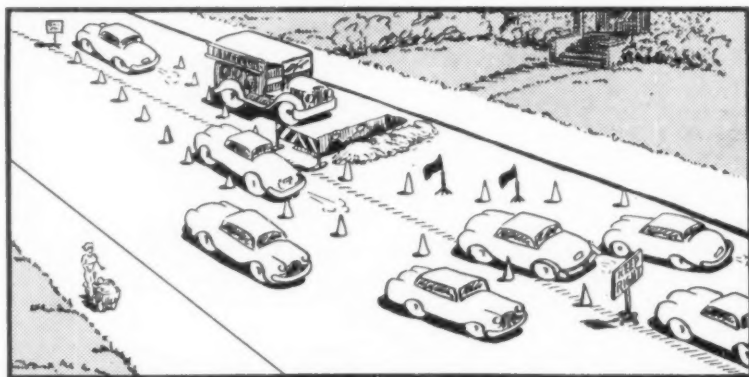
- 1) Date and time that work will commence.
- 2) Location of work by street address, length and width of work, which lanes of traffic, including

parking lanes, will be blocked or interfered with during the day.

- 3) Which of the blocked lanes will be made available for traffic between 7 am and 9 am and between 4 pm and 6 pm by means of temporary filling, use of steel cover plates, removal of debris or any other ways.

hand in the city and county before any portion of the excavation is made.

- 3) During the progress of the work a sign shall be maintained at the excavation in the street bearing the name of the utility or contractor doing the work.



● WHEN half of the roadway must be obstructed, traffic must be directed across center line, but effective barriers, guards, warning signs, etc., must be provided.

- 4) Probable date and time when work will be completed.

The Police Department will give advice and assistance in the re-routing of traffic where necessary, and may offer advice as to channeling traffic around the work by means of barricades and traffic cones furnished by the utility doing the work.

Street Excavation Regulations

Excavations in public streets for any purpose are governed by Article 8 of the Public Works Code entitled "Excavations In Streets." The principal provisions of the Code applying to utility work are briefly summarized in the following paragraphs:

- 1) All excavating and refilling shall be under the supervision of the Department of Public Works.

- 2) Application to excavate in a street must be made in advance, accompanied by a deposit to cover the cost of inspection. The application is required to show that all material to be used in the work will be on

- 4) Except with the consent of the Department of Public Works trenches shall not be opened for more than 600 feet in advance of the placing of pipe or conduit. Trenches must be backfilled and surplus excavated material removed immediately after completion of the installation.

- 5) Repaving over all trenches must be commenced immediately after the trenches are backfilled, and the necessary clearing up of the street must follow.

- 6) After completion of work and repaving of any trench the utility performing the work will be responsible for any repair or restoration of the surface in case it should become depressed or broken at any time in the future.

It is highly desirable to avoid doing work or creating obstructions during periods of heavy traffic flow. In congested business districts it may be necessary, and in some cases more economical, to perform neces-

sary work in the streets on Saturday or Sunday, or at night. This arrangement will, of course, always be beneficial from the standpoint of traffic and may also prove to be desirable, in spite of extra costs for premium pay, where traffic volumes are so heavy that work cannot be done efficiently during daytime hours.

In the downtown shopping area, and in other commercial districts throughout the city, traffic is unusually heavy during the Christmas Holiday Season and interference with vehicular movements is particularly harmful from the standpoint of both customers and merchants. Except for emergency work, no street or sidewalk openings should be undertaken in the downtown area from December 1 to January 1, inclusive, and in other commercial

to cross and to be joined by manholes, valves, vaults and other structures. The street intersection is also the most congested part of the street system from the standpoint of traffic flow. It is estimated that the intersection has only about 25 percent of the midblock traffic capacity. It follows, therefore, that more careful planning is required to program construction work which must be performed within or close to an intersection than is required for work in the middle of a block. It is also essential that special attention be given to the manholes in street intersections, both during construction and later when they must be opened for maintenance and repair purposes afterwards.

All of the following procedures for minimizing traffic interference apply with special emphasis to work

kept open only as long as necessary, consistent with the work being done, particularly if traffic flows are heavy.

At intersections, operations must be confined to half of the crossing and at least one lane must be kept open at all times.

Special attention must be given to the high volume streets listed in the "Schedule of Restrictions On Street Traffic Interference". On some streets excavations or manholes must be kept covered during peak hours of traffic flow.

Traffic stripes which cross manhole covers should be lined up when work is finished.

Barricades. Barricades required for protection of workers, motorists and pedestrians should be arranged to cause minimum inconvenience to the general public. The placement of barricades should be modified from time to time to reduce interference with traffic flow as this becomes possible.

The job should be provided with an ample supply of necessary equipment, including ropes, wooden fencing, folding horses, rubber cones, etc.

Barricaded areas should have advance warning signs to give motorists ample time to change course and merge with other traffic.

Work Near Curves or Crests of Hills. When manholes are opened or excavations made on or near a curve in the street or near the crest of a hill special attention must be given to the placement of barricades and signs.

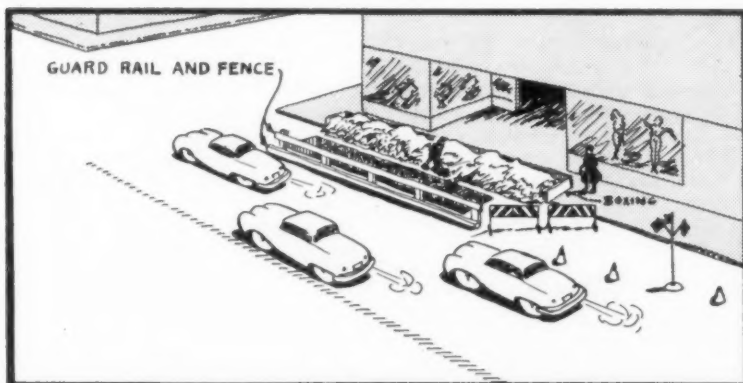
If traffic is to be diverted from its usual course, advance warning signs should be placed beyond the crest or nearby summit in the roadway so as to give motorists ample time to adjust their paths.

Similarly on curves where the sight distance is limited advance warning signs should be placed well in advance of the location of the work.

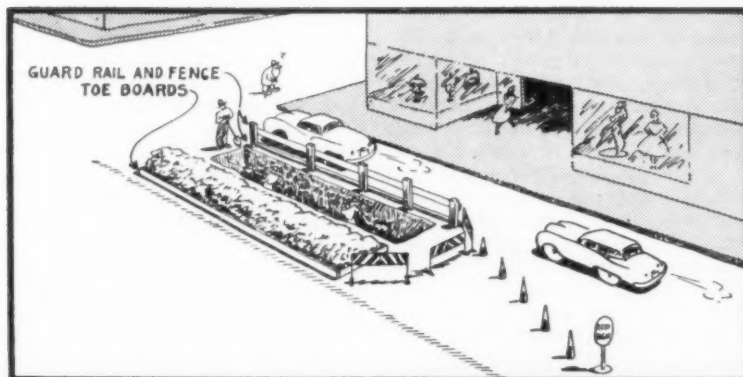
Shifting Lanes Around Work. When it is necessary to obstruct a full half of the roadway, it is possible to obtain Police Department approval to direct traffic across the center line into the other half of the street. Advice of the Police Department should be carefully followed.

The utility doing the work will still have the legal responsibility to protect the public by placing necessary barriers, guard rails, warning signs, etc.

With the approval of the Police Department, or at its request, flagmen should be provided to assist



● **SPOIL banks:** Material removed from excavation should be placed to occupy the least possible space. Drainage opening is needed if spoil is placed at curbside.



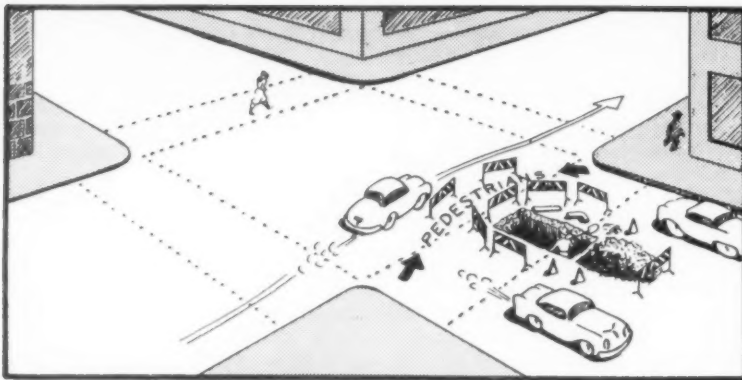
● **WHEN excavation is in center of street or in outer lane,** spoil is confined by bin or toe boards, a guard rail is placed on traffic side and signals guide passing cars.

districts from December 15 to January 1, inclusive. This applies to business districts consisting of one or more blocks of continuous retail stores.

The intersection of two streets is the natural location for utility lines

performed at or near intersections.

Open Excavations and Manholes. Since all open excavations and manholes are hazards, care must be taken to protect motorists, pedestrians and especially children against injury at all times. They should be



● **WHEN excavations encroach on a cross walk or on a pedestrian crossing, a detour or passage should be provided, with necessary barricades to protect pedestrian traffic.**

traffic in following the proper channels.

Usually two or more lines of traffic must be forced to merge into a single lane. To accomplish this smoothly, warning by means of signs or cones should be given as far in advance as possible.

Multiple Street Operations. The difficulty of avoiding interference with traffic is greatly increased if two utility operations take place in the same block at the same time, particularly if they are approximately opposite each other.

When one utility contemplates work in a block where another utility has work under way, or the same utility has another operation under way, every effort should be made to defer the work until the first operation has been completed.

Spoil Banks. Material removed from excavations should be placed so as to occupy a minimum width of roadway. At street intersections all spoil should be hauled away if possible and, at least, any surplus not later needed should be removed immediately.

When excavation is in an outer lane, confine excavation and spoil within outer lane by use of bin construction or toe boards to prevent spoil from spreading into and blocking another traffic lane. Provide a guard rail on the traffic side of trench.

When excavation is in the curb lane, place the spoil on the curb side, after first covering the gutter to permit free flow of drainage. Boxing of any spoil placed on the sidewalk is essential. Place guard rail on the traffic side of trench.

Work Equipment. Equipment such as pumps, mixers, excavators, tool boxes, trucks and other equipment should be placed on heavy traffic streets only when actually in use. Where a traffic lane is blocked by

an excavation, equipment, if possible should be placed in the same traffic lane. An effort should be made to avoid placing equipment at or near intersections because they are the most congested parts of the street system. When equipment must be near an intersection, it should be placed so it will not prevent motorists from seeing pedestrians or other vehicles in or near the crossing.

Pedestrian Crossings. At street intersections safe and convenient passageways must be provided for pedestrians. Where excavations encroach on the cross walk or pedestrian crossing, a detour with necessary barricades should be provided to separate vehicular and pedestrian traffic.

Use of Steel Plates

The proper and reasonable use of steel plates will materially reduce traffic interference. Consideration should be given to their use: 1) At street intersections to reduce traffic interference caused by an open trench, when no work is in progress; 2) across an open trench in driveways and on walks where required to provide safe passage for vehicles or pedestrians when work is being performed; and 3) when no work is being done at noon, nights, Saturdays or Sundays.

The edges of the plates should be held by black-top firmly tamped, as a hazard is often created when the approach is made of dirt. Plates should have angle cleats on the bottom to prevent possible displacement.

Trenches should be backfilled as soon as possible and filling material should be thoroughly tamped or jetted. If the finished surface is to be used immediately by traffic, prior to the placing of the permanent paving, it should be protected by a layer of black-top to prevent erosion and

keep down the dust. Temporary surfacing of this type should be patched from time to time if settlement takes place. The temporary surfacing should be replaced with permanent pavement as soon as possible.

Where work is done near signalized intersections, traffic detectors may be encountered at or near the site of the proposed work. If possible, traffic should be channeled in such a way that the traffic detectors will remain in normal operation since the traffic signals depend on them. Care should be taken to avoid damage to the detector installation. In no case should a truck or piece of equipment be parked on a detector since this will interfere with operation of the signals.

The safety of pedestrians and motorists at intersections depends upon the visibility of the signs or traffic signals which may be in place. In placing construction equipment or storing materials at the site of the work care should be taken to avoid the obscuring of signals, signs or other traffic markings.

This material has been condensed from a Manual prepared by the Streets Utilities Committee, San Francisco, Calif. The Director of the Department of Public Works is Sherman P. Duckel.

Activated Carbon Handling

Chicago now has one of the most complete systems of activated carbon handling of any filtration plant in the country. The powdered material is received in bulk in hopper-dump cars, made into a slurry in receiving tanks located underneath the railroad tracks and then pumped to feeding tanks located in the chemical building high enough to feed by gravity. The feeding devices consist of two rotodips for ordinary carbon dosages, two rotometers for high dosages and pumps which may be used for extremely high dosages. The capacity is such that the maximum need of activated carbon can be met without having to resort to the use of dry feed machines. Carbon purchases for delivery in hopper-dump cars is cheaper than in bags and the handling of the bulk carbon at the plant is much cheaper than handling bags. The cost of changing the system to slurry handling soon will be paid for by the saving in price of the carbon and in the labor required for handling. A major factor is that the worst condition of the water can be met by the new system. This was not possible by the system originally installed.

SANITARY ENGINEERING RESEARCH

International competition in science has stimulated the establishment of large research institutions. Despite this emphasis, men with ideas, wherever employed, continue to make significant contributions. Such men are especially important to sanitary engineering progress; for them, large scale support is not readily available. In this issue, Public Works once again emphasizes the role of the individual who, aside from his routine, cannot resist a challenge to explore uncharted areas. The following articles record briefly the work of the indispensable man with the idea and the curiosity that presage for us the developments and the practices of tomorrow.

Dr. Daniel A. Okun

THE ROLE OF THE FEDERAL GOVERNMENT IN SUPPORTING RESEARCH RELATED TO PUBLIC WORKS

National Science Foundation

GENE M. NORDBY,*

Head, Department of Civil Engineering,
University of Arizona

*Former Program Director for Engineering Sciences, National Science Foundation

IN THE FISCAL year 1957, the expenditure of this country for scientific research and development amounted to \$10 billion. This is over 2 percent of the gross national product. The Federal government contributed over \$3 billion directly to this total. Truly, research and development has become one of the major industries of this country—an industry on which the Federal government is especially dependent for its needs both in defense operations and in many peace-time activities.

More than 60 cents of every dollar of the Federal contribution was obligated for development and less

than 40 cents for research; and of this 40 cents only 8 cents was for basic research. Of special significance is the low percentage devoted to basic research since this expenditure provides the foundation for the applied research and all development which follows. Subdividing the dollar another way, 48 cents was spent within the Federal Government, 35 cents went to profit institutions and 14 cents went to educational institutions, representing nearly all the basic research money. A startling fact is that over one-fourth of all natural scientists and engineers, about 230,000, were employed in research and development in 1954, with 400,000 supporting personnel.

The time has come to examine critically our educational system in engineering to see if we can provide more proper training for the

work future engineers are going to do. Indeed, if discovery is going on at such a rapid pace, the engineering designer must also get increased training in science to make quicker use of these scientific advances as they are made. Many engineering schools are engaged in revisions of curricula to meet these needs.

How does research related to public works fit into this picture? Traditionalists among the engineering ranks often argue that basic research is of little use in the construction industry because uniqueness is at a premium; every structure is different. They feel that research leads to standardization—a novel argument coming from the most standardized and codified industry in the country. Very often new research is used to introduce modern practice. Certainly research is of more value when each struc-

ture is unique since it is only through research that one may generalize results so that they are more widely applicable to the various unique structures.

Of the many industries surveyed by the National Science Foundation the construction industry ranked as one of the lowest in its support of research activity, yet it is the largest of all American industries. Analysis of the Federal expenditures shows that the funds available for both in-house and extra-mural research in the public works field is completely dwarfed by the expenditures for defense. One must admit, however, that the discovery of a new method of disposing of sewage may be exciting to a small group of sanitary engineers, but it does not have the appeal to the general public that firing a satellite into space has. Still, one may have difficulty in thinking of a type of research which would have more economic impact or effect on the lives of our citizens than, for example, perfecting a non-shrinking concrete, devising a new biological process important to sewage treatment, or developing a new membrane for skin-type buildings.

Federal Sponsorship

Before discussing how this situation may be improved as far as Federal funds are concerned we should discuss what the Government is doing at present in contracting for research with outside organizations. In sponsoring research with non-profit institutions, Federal agencies may have either of two objectives in mind. They may be seeking scientific knowledge to assist them in carrying out the responsibilities with which they are charged—"purchasing" research and development services—or they may be seeking to add to the general fund of scientific knowledge as a matter of public interest.

In the case of "purchased" research and development, emphasis must necessarily be placed on the ability of an institution to perform a specific task expeditiously and achieve results of direct value to the interested agency. This type of research may be placed in private industry, in educational institutions, or non-profit research institutes or with any group competent to do the job. On the other hand, in supporting research and development as an aid to science, account must be taken of the relation of the proposed work to the long range progress of science; the development of research potential; the needs of geographical areas; and educational benefits.

Probably the most important agencies supporting research are the Public Health Service, interested in sanitary engineering; the National Science Foundation which maintains a general program in the engineering sciences; and the Bureau of Public Roads. Some of the others are Agricultural Research Service; Atomic Energy Commission; Corps of Engineers, Transportation Corps, Ordnance Corps (Office of Ordnance Research) and Quartermaster Corps of the Department of Army; the Office of Naval Research, Bureau of Ordnance, and Bureau of Yards and Docks of the Department of Navy; the Federal Civil Service Defense Administration; and the Tennessee Valley Authority. Almost all of these agencies work by what is known as the "proposal" system which is the device by which the scientist submits his idea for evaluation. Quite often engineers criticize the proposal system because it results in wasted time for those research projects rejected by the agency. Most engineers are trained to find answers to specifically defined problems, but in a proposal we are asking them to define problems and then to solve

our educational institutions. In the future, the University scientist will probably continue to be the key individual of the government contract or grant program in research. His leadership is needed in the conception of fresh, original ideas and in the exploration of new, fruitful fields in all scientific areas. It is the university environment and method of working which is conducive to this free-lance type of research. Many industries are now attempting to imitate this atmosphere in the hope of attracting good researchers.

To encourage basic research in all fields the National Science Foundation was created in 1950 as an independent agency of the Federal government. In part its responsibilities are to "Develop and encourage the pursuit of a National policy for the promotion of basic research and education in the sciences; to initiate and support basic scientific research in the mathematical, physical, medical, biological, engineering and other sciences. . . ." Unfortunately the majority of engineers are not aware of the National Science Foundation or show little interest in it. Although the emphasis in the Foundation has

Table 1—Growth of the Program for Engineering Sciences Since Its Inception

Fiscal Year	Proposals Received		Proposals Granted	
	Number	Dollar Value	Number	Dollar Value
1952	59	1,696,651	3	41,900
1953	96	1,472,707	18	145,300
1954	103	1,627,285	42	390,900
1955	110	1,952,758	64	724,200
1956	170	3,874,520	55	726,200
1957	207	5,704,455	80*	1,150,500**
1958	307	10,377,918	79	1,491,800
1959	2,600,000*

** or 102 proposals for \$1,348,350, including 17 research instrumentation and 5 short-time research-training grants.

* Not included are 15 conferences, facilities and publication proposals for total of \$286,645, of which 9 conference grants were made for a total of \$46,600.

° Estimated.

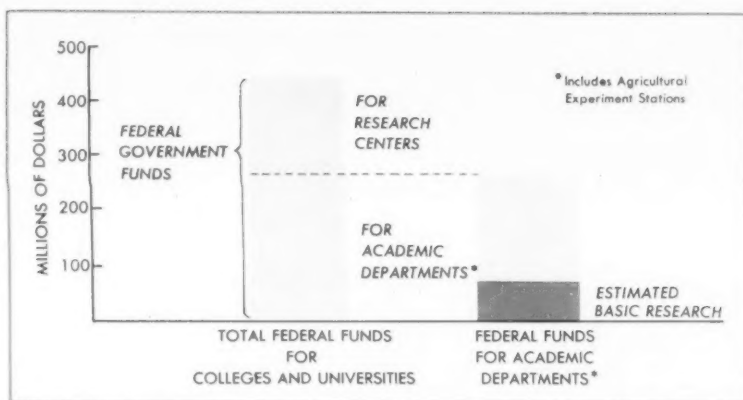
them. Only by this procedure, however, can the government draw upon the imagination of the whole scientific population rather than the imagination of a few government administrators. In fact, many agencies recommend that the scientist beware of orienting his research thinking and experimental studies along popular lines because of the mistaken belief that these will most readily receive support. He should not be reluctant to submit imaginative research proposals as long as they are well thought out.

For the most part the program of "basic research" has been aimed at supporting qualified professors in

always been weighted heavily toward "pure" science, it has substantial funds available for the engineering sciences. Starting in 1951 with only \$42,000, engineering sciences expenditures have gradually increased to an estimated \$2.6 million during the present fiscal year.

It must be emphasized, however, that the Program for Engineering Sciences of the National Science Foundation does not provide general support for all engineering research. The Foundation activity is limited by law to basic research.

The writer has found that both the engineer and the scientist have been lacking in ability to communicate



● **ESTIMATED** Federal funds for research and development allocated to colleges and universities, fiscal 1958. Note the small proportion devoted to basic research.

with their fellow men. In a democratic society it is the public who decides in the long run what will be done. We must make special efforts, therefore, to publicize the results of research in language understandable to them. We must learn to mesh gears with this public reaction in order to obtain continuity and support in fields other than space technology. Public works is one of them. It is the perfect example of a market made up of its states, cities, counties, contractors, consulting engineers and dispersed industry. The Federal Government must take the lead in supporting this research. Before it will, however, we must make the citizens and their elected representatives aware of our potential and its value to them. We must also see that the funds appropriated are properly distributed and administered with fairness to all fields. But even before this we must convince the majority of engineers that they have a stake in this effort and should work directly with their professional societies toward this goal.

Typical Projects

Typical of the few projects in the field of sanitary engineering is that of Prof. Vaughn Behn, University of Delaware, on the "Settling Behavior of Waste Suspension." Professor Behn has, through both theoretical and experimental work set forth the qualitative mechanism of a settling slurry. The two important phases of settling, the hindered or constant rate settling zone and the compression zone, were studied. In the latter an analogy between the compression zone and soil consolidation was proposed. The understanding of the mechanism of settling may have important ramifications in chemical engineering, hydraulics and soil mechanics. The Foundation would like

to receive more proposals in this area to balance its program better.

Typical of other research projects related to the public works field in general are a study of the fatigue of concrete by Professor Clyde Kesler at the University of Illinois; an examination of the forces exerted by wave motion on underwater structures on sloping beaches by Professor J. W. Johnson at the University of California; an analysis of the factors involved in the freezing of fine grained soils at Purdue University by Professor Gerald Leonards; and the development of a simplified strong motion earthquake recorder (to overcome the problem of oversensitivity of existing devices) by Professors D. E. Hudson and G. W. Housner at California Institute of Technology.

Grant Procedures

The National Science Foundation grants are simple and flexible. In a sense they are gifts, and consequently a minimum of reports and detailed information is requested from the grantee. The investigator is encouraged to publish reports in existing scientific journals thus putting his findings before the scientific public.

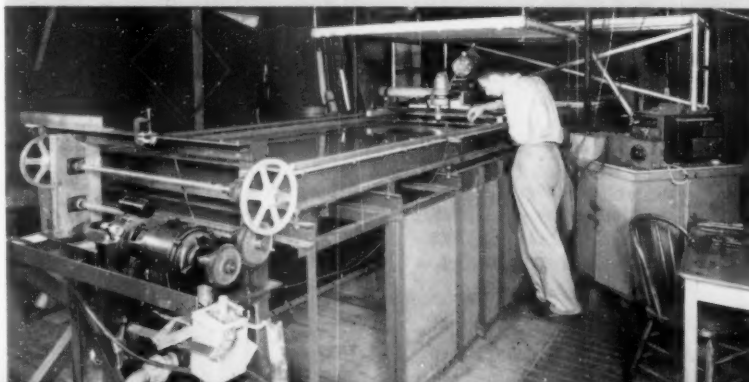
Grants for equipment are not considered separately, but are encouraged as part of all research proposals. The budget of a research project may consist of salaries, equipment and expendables or any item necessary to do the research. The justification for those budgets must always be in terms of the "basic" research to be done. The Foundation's responsibility for encouragement of research sometimes results in a project at an institution that has competent investigators but lacks necessary equipment to proceed. Equipment purchased through a grant becomes the property of the institution.

Federal agencies use both granting and contracting methods for supporting research. The National Science Foundation prefers, and uses almost exclusively, the granting procedure because it feels that the contracting method is incompatible with basic research. The reason for this is that basic research is a "quest for knowledge with intellectual curiosity as the only motivation." The investigator does not know what he is going to find so he can hardly obligate himself in advance to find it.

The National Science Foundation oftentimes supports young investigators; last year 35 percent of the grants in engineering sciences went to men under 35 years old. In addition, smaller schools are often supported, giving a present distribution of research throughout 43 states. The young man who has recently completed his Ph. D. work and who is still vitally interested in research is encouraged to submit proposals so that he may continue a research career.

Further information on the research activities, as well as science scholarships, foreign translations, support of publications and other activities may be obtained by writing the Program Director for Engineering Sciences, National Science Foundation, Washington 25, D. C.

● **CALIBRATION** of a parallel wire resistance type wave meter used to study forces of wave motion on underwater structures, a project of the University of California.



REAERATION OF OXYGEN-DEFICIENT NATURAL STREAMS

Tennessee Valley Authority

M. A. CHURCHILL,
Chief,
Stream Pollution Control Section,
Division of Health and Safety,
Tennessee Valley Authority

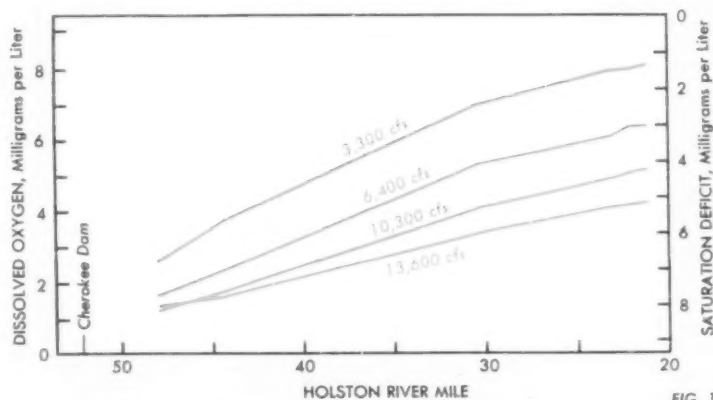
IN A NATURAL stream, dissolved oxygen is a pollution-absorbing asset. Any decrease in the concentration of this dissolved gas, below normal saturation, renders the stream less capable of assimilating organic pollution. As pollution discharged to a stream begins to use up the oxygen dissolved in the water, more oxygen is absorbed into the water from the atmosphere. If the stream can absorb oxygen rapidly enough, excessively low oxygen concentrations downstream from sources of pollution will not develop. If oxygen is not absorbed quickly enough, the stream becomes septic and dark, and unpleasant to the senses. Thus, the ability of a stream to absorb oxygen is of importance to every city and to every industry discharging organic wastes, inasmuch as the degree of waste treatment that must be provided is predicated on the ability of the receiving stream to assimilate the residual pollution satisfactorily.

At the present time, due primarily to the lack of dependable methods, only very rough approximations can be made of the pollution absorption capacity of a stream prior to actual discharge of a waste. An industry with a waste disposal problem, seeking a new plant location, is in a much better position to evaluate the probable cost of needed waste treatment facilities if the capacity of the stream for absorbing pollution at the site under consideration can be estimated with reasonable accuracy.

Those organizations planning to build dams for impounding reservoirs also have a need for information on the rate of reaeration to be expected in a river. It is well known that water released through deep outlets (usually turbine intakes) in storage impoundments is deficient in dissolved oxygen during the sum-

mer and fall months of the year. As this water flows downstream it gradually absorbs oxygen from the air but, in some cases, 50 or more miles are required before near-saturation conditions are reached. Figure 1 illustrates oxygen recovery in the Holston River in east Tennessee, below Cherokee Dam, for various rates of steady river flows. The

because of low oxygen concentrations in water supplied by many storage reservoirs, the variety of sizes and slopes in river channels, the possibility of studying the same river at several levels of steady flow since releases can be made by varying the number of turbines in use, and the freedom of pollution of many river reaches below the reser-



● REAERATION in the Holston River, Tennessee, observed below Cherokee Dam. At the lower flows the rate of oxygen recovery is higher, but total absorbed is less.

lower flows are reaerated in shorter river distances than the larger flows. At 3,300 cfs, the increase in dissolved oxygen concentrations was approximately 5 mg/L in some 27 river miles of flow, whereas the increase for 13,600 cfs was slightly less than 3 mg/L. However, in terms of total pounds of oxygen absorbed by the river, the higher of these two flows picked up over twice as much as the lower flow in the same river distance.

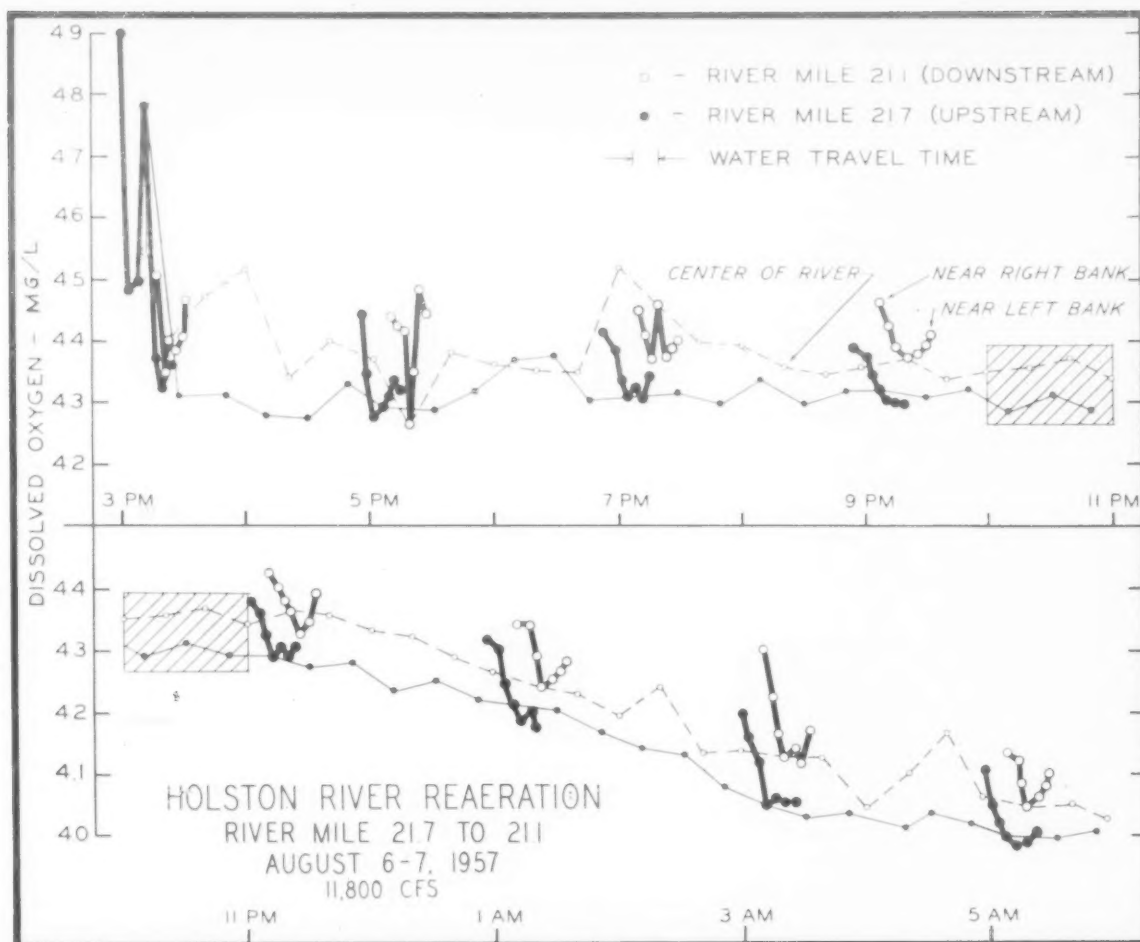
The Division of Health and Safety, Tennessee Valley Authority, initiated a research project in 1956 which has as its primary objective the development of a mathematical formula for predicting the rate of reaeration to be expected in any reach of any river.

TVA is in a rather unique position for carrying out the studies on which to base the prediction formula

voirs. If pollution were present, its oxygen demand would seriously interfere with the reaeration measurements.

The basic plan for the development of the prediction formula involves measuring actual reaeration rates in river reaches that are as hydraulically uniform as it is possible to find. The pertinent physical and hydraulic characteristics (mean depth, slope, velocity, resistance coefficient, etc.) of these reaches are also measured in appropriate numerical units. By observing the rate of reaeration in a wide variety of reaches, a firm base is available for correlating reaeration with all the pertinent physical and hydraulic variables that control it. The correlation is carried out by a statistical multiple regression technique.

Basic Data. The collection of the basic field data requires a field in-



● FIGURE 2. Reaeration during a travel of 0.6 mile is illustrated by the difference in DO level between the upstream points (solid dots) and the downstream points (white circles). Heavy lines show bank-to-bank profiles as determined at two-

hour intervals; light lines indicate DO levels determined at the center of the river at 15 to 20-minute intervals. Because of darkness, the DO level shows a general decline during the period of the test. Cross-hatch represents overlap of chart.

spection to select reaches of uniform physical and hydraulic characteristics. These reaches are cross sectioned at longitudinal intervals approximately equal to the width of the stream. A water surface profile is determined during a period of steady flow. From an examination of these data, the most nearly uniform are selected for study. The suitable reaches found to date vary in length from about half a mile to slightly over a mile.

During 1957, four suitable reaches were selected on the lower Clinch River, seven on the lower Holston, and four on the lower French Broad. Staff gages were installed and small steel cables were stretched across both ends of each reach. From these tag lines, drop lines were hung at locations to indicate laterally the approximate center of each one-seventh of the river's flow, for guidance of the sampling crews. River dis-

charges were held steady for approximately 24 hours, beginning about 6 a.m. on the dates, and at the flow levels, indicated in Table 1.

Beginning at 3 p.m. on the dates shown, after river flows had become stabilized, boat crews of two men each began collecting water samples

with dissolved oxygen samplers at each end of each study reach. At regular intervals water samples were collected from mid-depth at the location of each drop line. The water temperature was observed as each sample was collected. Sampling was continued until 6 a.m. of the following morning. On the Clinch River, for example, on the four reaches under study, eight boat crews of two men each were concurrently collecting water samples and observing water temperatures. Sample collection at the downstream end of each reach was lagged in time so that the water sampled at the upper end was again sampled at the lower end.

At the end of each sampling period, special samples were collected for the determination of the BOD of the water, for determination of total and dissolved solids, and for surface tension observations.

Table 1—River Flow Rates During Sampling Periods

River	1957	Steady Flow
	Date	Rate, cfs
Clinch	July 2	3,100
	July 9	5,900
Holston	July 16	3,300
	July 23	6,400
	July 30	10,300
	August 6	13,600
French Broad	August 13	3,700
	August 20	8,000
	August 27	11,900
	September 3	16,800

The seven samples collected in the cross section show a distinct pattern of oxygen concentration from river's edge to river's center. This variation is illustrated in Figure 2 by results on samples collected from one reach of the Holston River on August 6-7, 1957. The samples nearer the bank show higher concentrations than those nearer the center, the variation from near the edge to the center being as much as 0.2 mg/L or even more in a few cases. Less depth near the edge and more turbulence due to drag effects are responsible for this. For the flow conditions shown by Figure 2, the increase in oxygen concentrations from end to end of the reach averaged 0.07 mg/L, and the computed value of k_2 averaged 0.77.

The Public Health Service assigned a biologist to TVA for the summers of 1957 and 1958. This specialist supplies expert guidance in investigating the influence of plankton and attached plant forms on observed oxygen concentrations. The observed increase in oxygen concentration, from the upper to the lower end of the reach, is corrected hourly to offset the effects of photosynthesis and respiration. The quantitative effects of temperature on reaeration are also being studied.

Sample Analysis for DO Concentration. The equipment selected for dissolved oxygen determinations was an amperometric titrator. Precision attainable is such that the standard

Preliminary Form of Reaeration Prediction Formula

$$k_2 = A \frac{V^{b_1}}{D^{b_2}} S^{c_1} \left(\frac{V \rho D}{\mu} \right)^{e_1} \left(\frac{\sigma}{\mu V} \right)^{f_1}$$

In which, k_2 = reaeration coefficient

V = mean velocity

D = mean depth

S = energy slope coefficient

ρ = density

μ = dynamic viscosity

σ = surface tension

A, b, c, d, e, f are constants

deviation for several groups of 10 replicates each was 0.007 mg/L. Thus, even with an actual increase in DO throughout the length of a reach of only 0.1 mg/L, the errors in laboratory determinations should represent but an insignificant proportion of the true increase in concentration.

In the field, the DO is "fixed" in each sample by carrying the analysis procedure through the acid stage. The water seal around the stopper of each sample bottle is held in place by use of an inverted water-filled rubber finger cot. The samples are protected from the sun and trucked to the laboratory immediately following the completion of sampling.

The DO concentration of each sample is determined to the nearest 0.01 mg/L, with about two minutes required per determination. To avoid any possibility of sample deterioration (determined by prior experimentation to be negligible up to 100 hours), the laboratory chemists work in shifts around the clock until all analyses are completed.

Work Yet To Be Done. The range of observations will be extended to smaller rivers having steeper slopes and greater turbulence. After these data have been obtained in the fall of 1959, all the data collected to that time will be correlated in an equation having a general form developed with the aid of dimensional analysis. This technique allows all pertinent, and even possibly-pertinent, variables to be included in an organized, dimensionally-consistent, fashion. By statistical multiplication regression procedures, the necessary coefficients and exponents of the variables can be evaluated with an electronic computer following, basically, least-squares techniques. Each of the terms in the equation will then be examined to determine its statistical significance and the formula simplified by dropping all terms that add little or nothing to the accuracy of prediction. It is anticipated that this dimensionally-consistent equation can be simplified considerably for practical application and should be available in final form by late 1960.

CARRYING CAPACITY of WATER MAINS

State Water Survey Division of Illinois

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SURVIVAL and retirement experience for cast iron water mains in 25 representative cities has shown that 96 percent of all 6-inch or larger cast iron pipe is still in service. This is a remarkable record and fortunate because the distribution systems, which are buried underground and exceedingly costly to replace, represent 65 percent of water system values.

Efficient delivery of water is dependent upon the hydraulic characteristics of the pipe, and it is therefore mandatory that water works operations be designed to maintain interior surfaces or distribution pipes which are smooth and will obtain the most efficient delivery of water.

In some areas as a result of treatment or lack of treatment, improper water quality may cause a gradual incrustation or tuberculation of the interior of the pipe surface and, consequently an increasingly higher pumping cost. Greater pressure is required to deliver water at a given

rate through rough pipe than through smooth pipe.

Loss in carrying capacity with time may result from: 1) Deposition of silt from untreated water; 2) slime or bacterial growths clinging to the surface; or 3) tuberculation or after-precipitation of insoluble products on the pipe wall.

Tuberculation is composed of hardened, insoluble corrosion products in the form of nodules or spicules at various degrees of frequency on the pipe surface. As an uneven deposit, it interrupts the normal, smooth flow of water over the surface and causes eddies or cross-

current velocities into the main body of the usual pattern of flow. Deposits therefore have very real costs in dollars and cents. Closely spaced tubercles or average height of half-inch may reduce the capacity of a 24-inch pipe to deliver water, by 45 percent.

The Illinois State Water Survey, with the aid of grants from the National Institutes of Health is studying the effect that treatment methods may have on the carrying capacity of water mains.

Tuberculation

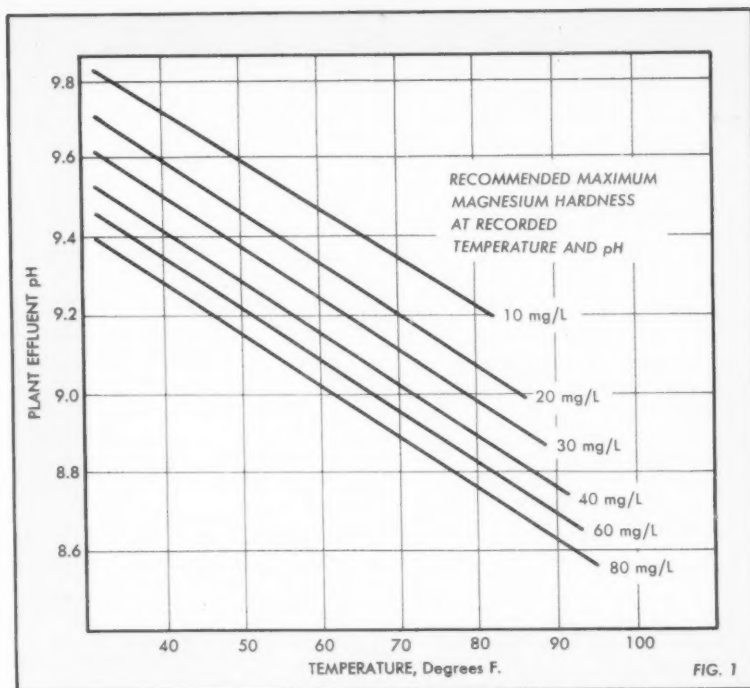
These studies are concerned mainly with laboratory tests on corrosion rates and with the development of tubercles. Although corrosion is essential to the development of tuberculation, the degree or magnitude of tuberculation is not proportionally related to the rate of corrosion.

It has been found that, in the presence of dissolved oxygen, corrosion rates decrease for waters containing increasing concentrations of calcium and of bicarbonate ions (usually expressed as alkalinity). When the concentration of these two ingredients reaches or exceeds the solubility of calcium carbonate, corrosion rates are usually negligible. However, if the concentrations are near, but slightly less than the amount required for saturation, the corrosion products are more likely to be tubercular. The velocity of water flow, depending on other factors, may also enhance or inhibit both corrosion rates and the formation of tubercles.

The presence of minor concentrations of other minerals or additives in water may also influence both corrosion and tuberculation, and it is the purpose of further studies to evaluate these factors.

Magnesium Hydroxide

A second form of incrustation is associated with lime-softened waters. Improper treatment with lime and soda ash has resulted in the precipitation and deposition of magnesium hydroxide in water mains. This deposition of magnesium hydroxide, unlike a smooth calcium carbonate coating, is recognized as a wavy or rippled surface. Its "semi-plasticity" causes it to take the form promoted by turbulence at the pipe surface during the flow of water. The effect of this deposition on carrying capacity is of great magnitude. A rippled surface only one-eighth inch thick in a 48-inch main may reduce the capacity to deliver water by 30 percent. After-precipitation of alum or improper filtration



From Fig. 1, J.A.W.W.A., 43, 650, 1951

● MAXIMUM permissible magnesium concentrations to avoid deposition problems.

at alum coagulation plants has also resulted in a similar type of rippled deposit.

A possible forewarning of magnesium hydroxide deposition is the serious accumulation of soft white deposits in hot water tanks or wavy rough deposits in hot water lines. Magnesium hydroxide has considerably less solubility at higher temperatures.

A properly treated lime-soda softened water should not be super-

saturated with magnesium hydroxide at the distribution temperature; and to avoid deposition at higher temperatures, the concentration should be considerably below saturation at the distribution temperature. The maximum permissible magnesium concentration (calc. as CaCO_3) is indicated for various plant effluent temperatures and pH in Figure 1. As a general rule it may be said that the pH should not exceed 9.0 nor magnesium hardness 40 mg/L. Some excesses are permissible in winter months.

Red Water

As an equally important general rule for prevention of "red water" problems resulting from corrosion, the plant effluent alkalinity should be 50 mg/L or more and the calcium hardness and pH adjusted to at least some degree of supersaturation with respect to the calculated solubility of calcium carbonate.

These suggested rules have not always been reported as successful. In some cases they have failed due to faulty analytical work but there are also certain limitations to protection by calcium carbonate deposition. For instance, there are many waters with extremely low alkalinities for which application of this type of treatment may be uneconomical. In these cases, other means of protection must be adopted.



● THIS 12-in. water main has lost 30 percent of its capacity to deliver water. Composition of deposit dried at 105°C: Al_2O_3 , 43%; SiO_2 , 21%, CaO , 2%; Fe_2O_3 , 3%. Ignition loss, 31%.

THE ELECTRON MICROSCOPE AS AN AID IN WATER QUALITY RESEARCH and CONTROL

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Asst. Chief Water Chem. Engr.,

and

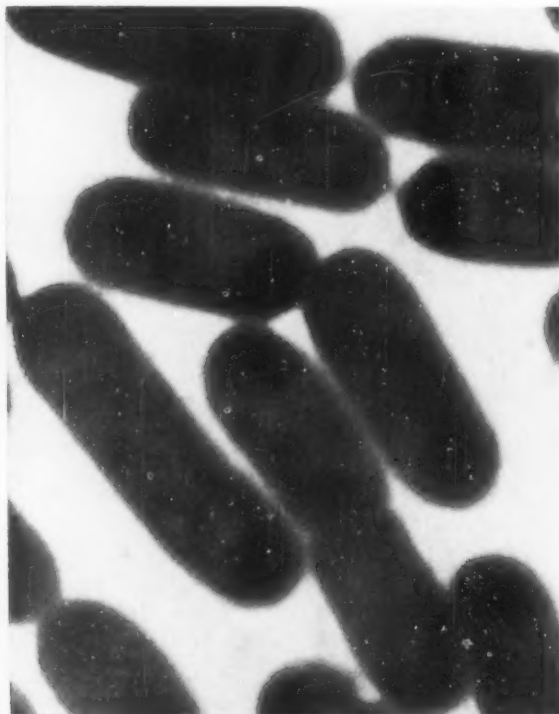
LEE SCARCE,
Water Bacteriologist III,
South District Filtration Plants,
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City of Chicago

WHEN ELECTRON microscopes first became available W. W. DeBerard, then City Engineer of Chicago, felt that this instrument might permit water testing laboratories to shorten the rather tedious and long drawn out bacteriological testing procedure, requiring 48 to

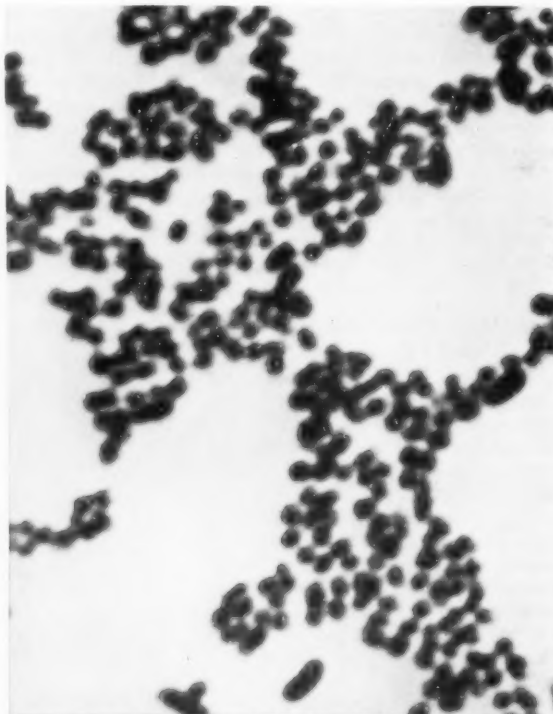
72 hrs. For most water supply systems, after this length of time the water being tested has been consumed, and bacteriological results are history and must be used primarily to evaluate methods of treatment. A console model of an electron microscope, manufactured by the Radio Corporation of America, capable of magnifying up to 5,000 diameters was purchased and installed in November, 1947. In early 1955, an RCA research model electron microscope, capable of magnifying up to 32,000 diameters was placed in service. It is the purpose of this article to outline how these microscopes are used as aids in water quality control and research

at the South District Filtration Plant in the Department of Water and Sewers at Chicago.

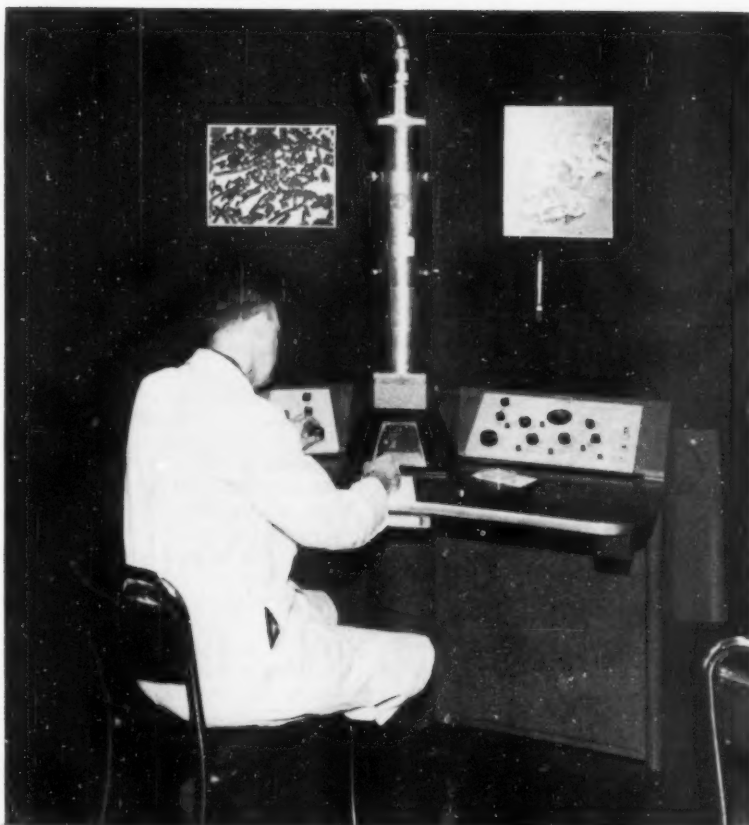
The principal application of the electron microscope has, of course, been in the field of shortening the bacteriological test method. In general, the method followed consists of taking the 24-hr. lactose presumptive tubes, which are usually available after 16 to 18 hrs. incubation, preparing a specimen by appropriate steps and examining it directly on the electron microscope. The preparation and examination of the specimen usually requires an additional 2 hrs. This means that the final result on the presence or absence of coliform bacteria may be



● ELECTRON micrograph of coliform bacteria, 16,400X magnification. Compare with optical micrograph at right.



● OPTICAL micrograph of coliform bacteria, 3,600X magnification, lacks definition and clarity for studying.



● MICROGRAPHS with a total magnification of 250,000X, using photo enlargement, and 32,000X for specimen images are possible with an electron microscope.

available in 18 to 20 hrs. as compared with the 48 to 72 hrs. required by Standard Methods. This has proven most valuable as a public health tool and as a public relations aid in situations such as sterilization of water mains and in disaster, such as flooding, which occurred in October, 1956, and July, 1957. In 1957, samples from 184 water mains were examined.

Quick Identification

Accepted methods for the identification of bacteria have always been by special media. The electron microscope, on the other hand readily demonstrates differences in gross morphology. Cocci are easily differentiated from bacilli and coliform organisms from both these general types. Species identification is, of course, not possible, but with the present developed techniques it is possible to ascertain the presence or absence of enteric or closely related strains. Thus, if a given sample has only bacilli, which is most often the case, a clean bill of health can be given in a matter of a few hours. This is most important to consumers

who have their water supply shut off due to the installation and chlorination of a new main.

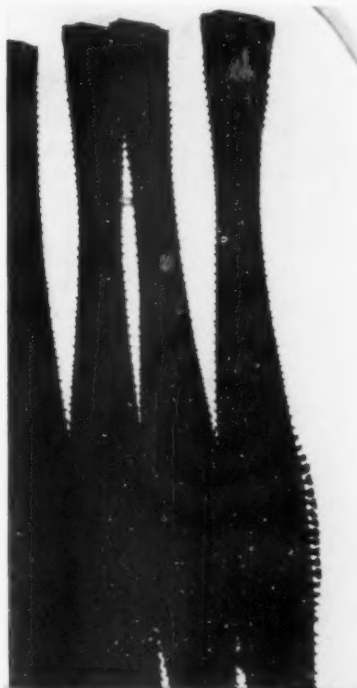
In the more than ten years of experience with the electron microscope, a running comparison has been maintained between the electron microscope method and the Standard Methods procedure. In 1957 the correlation between the two methods in the examination of over 4,600 samples was 97.3 percent.

In cooperation with Ralph E. Noble, Water Bacteriologist IV, much time has been devoted to an attempt to shorten further the period of testing of coliform bacteria. Numerous types of special "acceleration" media have been tried. When coliform bacterial levels were low, the minimum incubation period required, even with the accelerated media, was 10 hrs. This was not much of an improvement over the 16 to 18 hrs. normally obtained. When the coliform bacterial levels were high, the minimum incubation period could be shortened to as little as 7 hrs. without reducing the chances of positive identification. This development has permitted the direct examination of

highly polluted samples of water with some success.

The second most general use of the electron microscope is in the study of plankton, particularly the diatoms. Often in objects of this size the electrons do not penetrate through the cells and the photograph gives merely a silhouette of the cell. For example, the saw-tooth edges cannot be detected with the light microscope. In the illustration showing an electron micrograph of *Fragilaria* cells, on the right side along the edge there are interlocking dovetail projections on the cell that mesh with similar projections on another cell. This demonstrates the usefulness of the electron microscope in studying microscopic organisms. For years microbiologists have wondered how the *Fragilaria* cells were able to hold together in rafts of cells, sometimes with hundreds of cells in the raft.

During the past three years a new diatom has appeared in the water supply at the South District Filtration Plant. This organism, known as *Stephanodiscus hantzschii*, has occurred in the raw water in numbers as high as 11,000 per ml. While most of these organ-



● AN Electron Micrograph of the diatom, *Fragilaria*, shows the dovetail projections which allow cells to interlock. Original magnification was 4480X; this is reproduced one-half the size of the original photograph.



● IRON floc, shadow-cast with chromium to increase visual detail for study. Shadow casting permits three dimensional calculations with electron micrographs.

isms were removed from the water by settling, some were not. Since they are small enough to pass through the sand filters, counts of this organism as high as 12 per ml were found in the filtered water.

Another use of the electron microscope is in studying the products of corrosion. With the light microscope, small particles of iron rust generally cannot be distinguished from bacteria except by well experienced workers. With the electron microscope, bacteria are easily distinguished from rust particles. The electron micrograph is magnified to 8,400 diameters at which ordinary bacteria become sizable objects. The regular shape of the bacteria compared with the irregular shape of the rust particles makes the identification of bacteria positive.

In any water plant, coagulation is an ever present problem. There always comes the time when the operator cannot coagulate the water in a manner that is both satisfactory and economical and he wonders why. The electron microscope is a tool that aids materially in such investigations. The structure of floc formed under control conditions may be examined through techniques now available. In one of these

techniques the specimen of floc is frozen under sub-zero conditions. This fixes the particle shape. It is then dried under greatly reduced vacuum and given a very thin coating of chromium or gold or mixtures of the two. This treatment gives the floc particle rigidity. The specimen is then placed in the electron microscope and examined. The length of

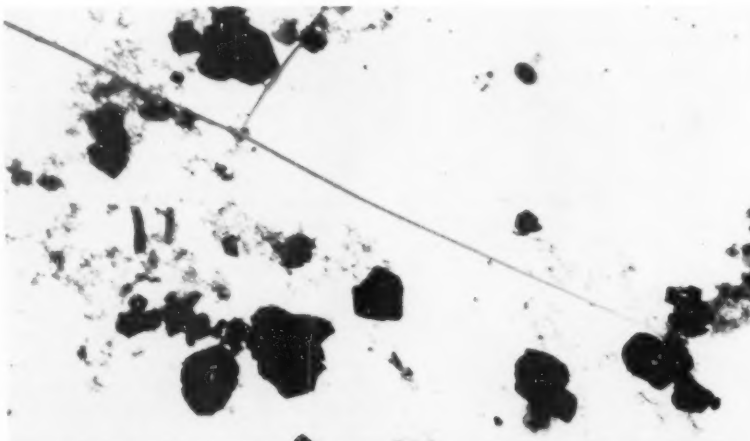
the shadows cast gives the observer a means of calculating the third dimension or height of the floc particles. This general technique is known as "shadow-casting."

In this work it is important to study the sediment in the water that is to be coagulated or, possibly, that which is difficult to coagulate. In these studies the ability to determine particle size in the submicron range becomes most important. In particle size measurements, the actual magnifying power of the electron microscope must be closely checked. A surface replica of Dr. Wood's diffraction grating with 30,000 lines to the inch was used as a means of ascertaining directly the magnification of the floc particles.

The South District Filtration Plant is operated by the Division of Water Purification in the Bureau of Water, Department of Water and Sewers for the City of Chicago. John R. Baylis is Engineer of Water Purification, Oscar Gullans is Chief Water Chemical Engineer, H. H. Gerstein is Asst. Chief Water Engineer, W. W. DeBerard is Chief Water Engineer of the Bureau of Water and Deputy Commissioner for Water, James W. Jardine is Commissioner of Water and Sewers. To each of these appreciation is expressed for their enthusiasm, guidance and support in the programs described.

References

1. DeBerard, W. W. & Baylis, J. R. New Vistas in Water Quality Research. *Eng. News-Rec.*, 140:639 (April 29, 1948).
2. Baylis, John R., Use of Electron Microscope in Water Treatment Control. *Jour. A.W.W.A.*, Vol. 42, No. 1, January 1950.



● SUSPENDED matter in Lake Michigan raw water, concentrated by centrifugation, contains diatom fragments, made visible by electron micrograph, 6,000X.

IDENTIFICATION of ODORIFEROUS SUBSTANCES PRODUCED BY ORGANISMS in WATER

Water works operators have long been plagued by odoriferous substances produced by algae and other organisms. Such substances often pass through water treatment plants, being only partly removed even by intensive treatment with activated carbon or chlorine. To control their effects intelligently, we are forced to learn more about the chemical identity of these compounds. Two studies by the Robert A. Taft Sanitary Engineering Center, Public Health Service are reported here.

IDENTIFICATION OF ODOR PRODUCING SUBSTANCES ELABORATED BY ALGAE

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THE ALGAE are reported to be responsible for multitudes of odors;¹ however, the evidence for many odors is generally circumstantial. In most cases, the alga present in the greatest concentration is tagged as the offender. The only reliable assay to determine whether an alga actually produces an odor is to observe it under carefully controlled experimental conditions. This necessitates the use of pure cultures of algae—that is, a single species which has been freed from all other organisms.

When research was inaugurated at the Robert A. Taft Sanitary Engineering Center to investigate the cause of odor production by algae, the initial step was, therefore, to obtain pure cultures of algae. After such cultures were obtained, those species of algae which produce odoriferous substances could be determined. One of the common green algae, *Chlorococcum macrostigmatum*, was chosen as the initial test organism.

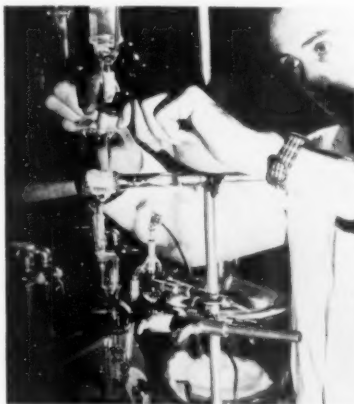
The preliminary step was to obtain volatile materials by steam or vacuum distillations. The volatile material collected in this manner

was slightly acidic (pH 5.0 to 6.0). More comprehensive steam distillation procedures were carried out, and acidic, neutral and basic fractions were obtained. Threshold odor tests performed on these fractions showed that each contained odoriferous substances, and hence that a combination or a complex mixture of compounds was being dealt with. This approach presents the difficulty of obtaining sufficient material for further chemical analysis. However, since odoriferous material present in the culture in minute quantities may yet reveal itself

strongly, analytical methods as chromatography, which require only small samples, may be employed to identify these odorous compounds.

Unlike other microorganisms such as bacteria and yeasts, the algae are relatively slow growers. While a heavy growth of these other microorganisms can be obtained in 24 to 48 hours, an alga often requires 8 to 10 days to reach the peak of its exponential growth phase.

Special attention has been given to the relation of algal lipides to odor production. The total lipide fraction of a green alga has an extremely high odor threshold. This odor is complex and has been described in many different ways depending upon subjective associations and past experience. The lipide content of the algal cell increases with the age of the culture and there is a concomitant decrease in cellular nitrogen and an obvious reduction in chlorophyll content. As the fraction of total lipide increases, there is an increase in the amount of free fatty acids present. This observation is in agreement with reports on *Chlorella pyrenoidosa*.² The odor of the lipide extract appears to vary with the age of the culture. A young culture has a grassy odor, while an older culture has an odor resembling that of tallow, probably due to the accumulation of long chain fatty acids in the older cultures.



Courtesy Allan Kain, Cincinnati Enquirer

● ODORS in small samples may be analyzed by chromatographic methods.

The role of the algae in causing odor problems in water supplies is complex. Not only must all the odoriferous compounds be identified, but more information must be gained on their production. This will require more work on elucidation of the metabolic pathways of the algae.

IDENTIFICATION OF ODORS PRODUCED BY ACTINOMYCETES

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THE ACTINOMYCETES are another group of organisms that have been implicated in the production of tastes and odors in water supplies. Odors of the "earthy" type are generally attributed to them. Actinomycetes are unicellular, filamentous organisms and are frequently looked upon as a separate group occupying a position between the fungi and the bacteria, although they are classified among the bacteria. Their small size suggests bacteria, but their mode of filamentous growth and sporulation resembles that of fungi. Unlike the algae, which are photosynthetic, actinomycetes are obligate heterotrophs that require preformed organic matter as a source of energy for growth. They are extremely non-fastidious in this requirement, however, and can utilize a great variety of organic materials, including simple sugars and amino acids, various alcohols and organic acids, and numerous resistant materials which occur in nature, such as cellulose and chitin. It is for this reason that actinomycetes are widely distributed.¹

The ability of these organisms to produce "earthy" odors has long been recognized. In 1896 Rullman² isolated a culture which he called *Cladothrix odorifera* and described its intense earthy odor. His description of the organism leaves no doubt that he was dealing with an actinomycete. Adams³ apparently was the first to connect the earthy odor of water with actinomycetes. In 1929, he drew attention to the occurrence of an earthy odor in water from the River Nile and suggested contamination by actinomycetes. Thaysen⁴ in 1936 investigated the origin of earthy odors that tainted

References

1. Whipple, G.C., Fair, G.M., and Whipple, M.C. 1948. *The Microscopy of Drinking Water*. Fourth Edition. John Wiley & Sons, Inc., New York, N.Y.
2. Milner, H.W. 1948. "The Fatty Acids of *Chlorella*." *Jour. Biol. Chem.*, Vol. 176, pp 813-817.

fish in a rich salmon stream in the United Kingdom. He found strong odors along certain banks of the river, particularly muddy banks with submerged reeds. The numbers of actinomycetes in the mud were correspondingly great, although the numbers in the water were never found to be high. He thus concluded that the odor was produced by these organisms, that the primary site of their development was in the exposed banks rather than in the water itself, and that the taste or odor developed in the stream as their metabolic products were dissolved in the river water. Similar conclusions were reached by Issatchenko⁵ who investigated the Moscow River, and by Ferramola⁶ who studied the River Plate in Argentina.

The removal of earthy tastes and odors from raw water has presented difficulty, as the conventional methods used in water treatment, such as chlorination and activated carbon addition, have not been uniformly successful.⁷ It was felt that a more effective approach to the problem of control could be made if more information were available on the

chemical nature of the substances involved.

A large number of actinomycetes have been isolated in pure culture from river and lake waters and muds by standard bacteriological dilution and plating techniques, using culture media somewhat selective for actinomycetes. A number of media listed by Waksman¹ have been found suitable for this purpose. After isolation, the organisms have been propagated in mass liquid cultures in order to produce a sufficient quantity of odoriferous substance. Liquid cultures having odor threshold numbers as high as 50,000 have been obtained in this way. Acidification of the culture depressed the odor, indicating that the odoriferous material was basic in nature and that a less volatile salt had formed on acidification.

These cultures have been fractionated in attempts to isolate odoriferous components. A preliminary separation was made by steam distillation of the culture fluid at an alkaline pH. The distillate collected in this manner was highly odoriferous. Considerable concentration was then achieved by extracting the distillate with ether and then removing the ether by distillation at reduced pressure. Concentrates have been achieved in this manner with odor threshold numbers as high as six billion, but the total amount of material recoverable is extremely small. It is apparent that this material, although produced in minute amounts, possesses an extremely intense odor. Efforts are now being made to collect sufficient material to allow further purification and determination of physical and chemical properties. Chromatographic methods are useful here as in the algae odor studies where the supply of experimental material is

● LARGE quantities of actinomycetes isolates are cultured in a constant temperature room. The harvested cultures are chemically fractionated to identify odors.

Courtesy of R. A. Taft Sanitary Engineering Center



limited. Accordingly, experiments involving adsorption chromatography, ion exchange chromatography, and vapor phase partition chromatography are being pursued, and it is anticipated that more definitive data will be forthcoming.

References

1. Waksman, S. A., "The Actinomycetes, Their Nature, Occurrence, Activities and Importance." *Chronica*

Botanica, Waltham, Mass. 1950.

2. Rullman, W. 1896. "Weitere Mitteilungen über *Cladothrix dichotoma* und *odorifera*." *Zentralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten*, Abteilung II, 2:701.
3. Adams, B.A., 1929. "Odors in Water of the Nile River." *Water and Water Engineering*, London, 31:309.
4. Thaysen, A. C., 1936. "The Origin of an Earthy or Muddy Taint in Fish." *Annals of Applied Biology*, 23:99.
5. Issatchenko, B., and Egorova, A.A.

1944. "Actinomycetes in Reservoirs, as One of the Causes Responsible for the Earthy Smell of their Waters." *Mikrobiologiya* (U.S.S.R.), 13:216.

6. Ferramola, R. 1949. "Earthy Odors Produced by *Streptomyces* in Water." *Journal of the Inter-American Association of Sanitary Engineering*, 2:371.
7. Silvey, J.K., and Roach, A.W. 1956. "Actinomycetes May Cause Tastes and Odors in Water Supplies." *PUBLIC WORKS*, 87: No. 5: 103.

OXIDATION of ORGANIC WASTES in SOIL and OIL CARRIAGE of SEWAGE

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Chairman,

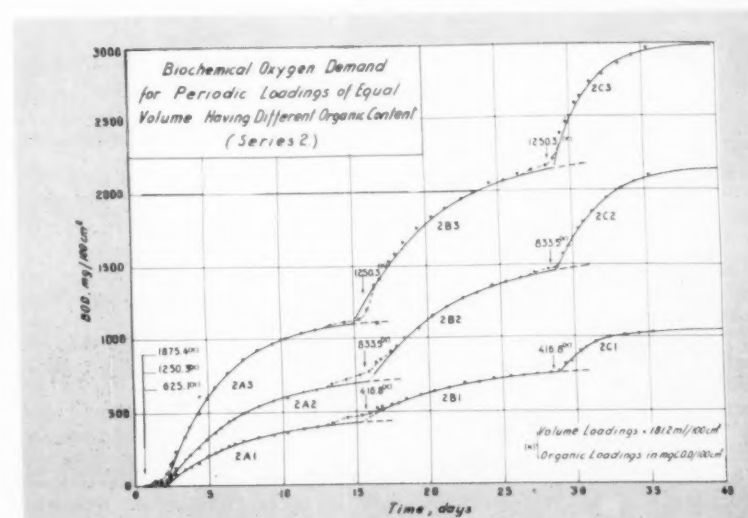
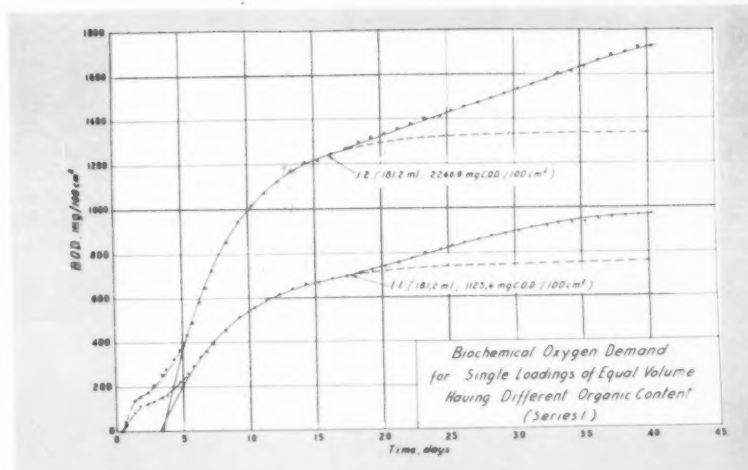
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RESEARCH investigations currently under way at Northwestern include work on the disposal of radioactive wastes; the filterability of Lake Michigan water; a mathematical analysis of sewage treatment costs and efficiencies; certain aspects of the use of algae in sewage treatment; the use of oil as a carrier for domestic wastes; and a study of the disposal of sewage effluents in the ground. The two latter projects are summarized here-with:

Oxidation of Organic Wastes in Soil. The disposal of raw and treated sewage by spreading on the surface of the ground or by discharging in underground pipes or wells is common practice. The absorptive capacity of the soil is usually the critical design feature. Relatively little scientific investigation has been carried out on this relationship, and it is Northwestern's intention to make this a major field of investigation over a period of several years.

The first part of this research is now under way under the immediate direction of John Costopolous, a graduate student on leave from the Greek Ministry of Health. This study comprises an investigation of the rate of oxidation of organic wastes in soil. Rates are measured by observing the amount of oxygen absorbed from the air in a closed system. An artificial waste is used, made from skim milk powder; the soil is a fine, uniform, inorganic sand and seeding is provided

Northwestern University



● RATE of oxidation of wastes in soil increases as greater volumes are applied.

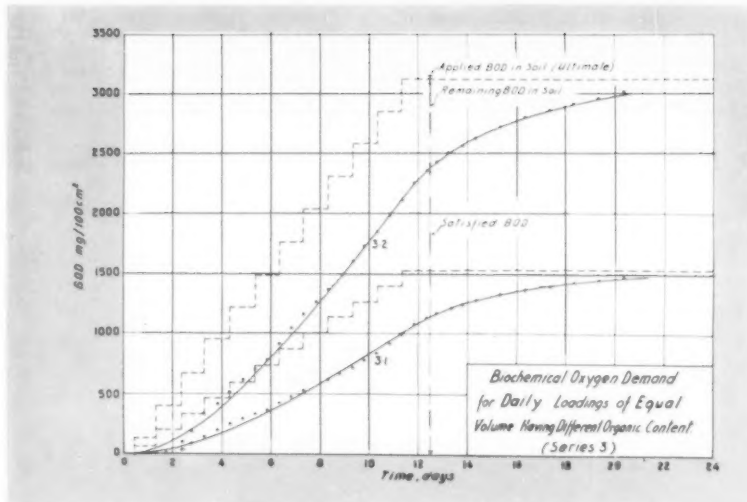
through the use of a dilute domestic sewage.

The immediate objectives of this first investigation are to determine the rate at which oxidation proceeds under a variety of different loading conditions, to formulate these and to compare them with other standard oxidation processes. A series of four different runs have been made, all at controlled laboratory temperatures: a) Equal volumes of waste containing different amounts of organic matter applied once to each of three beds; b) equal volumes of waste containing different amounts of organic matter applied intermittently at long intervals to each of three beds; c) equal volumes of waste containing different amounts of matter applied daily to each of three beds; and d) different volumes of waste containing the same total amount of organic matter applied intermittently to each of three beds.

The apparatus used, although relatively simple, apparently provides a true measure of oxygen demand and biological activity. A comparison of the BOD curves with those of standard BOD tests (using incubated bottle samples) shows a very close similarity, with a lag period and a first and second stage oxidation. The lag-time was found to be independent of the organic load and was eliminated when an active first-stage oxidation existed in the soil at the time of loading.

The progress of first stage oxidation, formulated as a first-order chemical reaction, gave close agreement with the experimental results. The ratio of the BOD to the applied COD was found to be from 0.65 to 0.70 and to be fairly independent of the loading, although there was some decrease as the volume increased.

With relatively small amounts of organic matter, most of which is strained out in the top layer of the sand bed, complete oxidation is obtained at a rate depending on the



● RELATIONSHIPS of applied, satisfied and remaining BOD with daily loadings.

temperature. This rate compares favorably with that obtained in bottle dilutions in the presence of adequate amounts of oxygen, and can be considered as having comparable efficiency. As the volume of waste is increased, the organic material is forced further into the bed and the rate of oxidation decreases.

With intermittent loading, the accumulation of unoxidized organic matter and the rate of oxidation tend to a limit, where the applied BOD at each interval of time equals the BOD satisfied during the same time. This is expressed as:

$$\text{limit } L = \frac{1}{1 - e^{-kT}}$$

where L is the accumulated BOD in the soil; 1 is the amount of BOD applied during each loading; T the time interval of loading; k the coefficient of oxidation; and e is the base of napierian logarithms, 2.7128. For continuous application, the limit

$$L = \frac{1_0}{k} \quad \text{where } 1_0 \text{ is the amount of BOD applied per unit of time.}$$

available to maintain the slurries in suspension are being investigated in conjunction with the hydraulic investigations. Loss of head characteristics are a part of this portion of the study.

The problem of combustion is essentially one of nozzle design. The addition of domestic waste to oil increases its fuel value, but to burn this mixture in the heating plants now in use requires modification of the almost universally-used atomizing nozzle. The most promising solution appears to be the use of a "rotary cup" type; oil is delivered under pressure and is atomized by being dropped into a small cup which rotates at high speed with auxiliary air forced into the combustion chamber. Tests so far carried out show no special problem of residues or interference with normal combustion.



● FIELD investigation of a burner for field combustion of oil-carried sewage.

Oil-Carriage of Sewage. Isolated groups of military men face special environmental problems in the arctic, particularly when they are located at sites where water is not readily available. Because of this shortage and the long periods of extremely low temperatures, personal sanitation becomes difficult.

For the heat and power needed at arctic sites, fuel oil must be provided. This has suggested the use of fuel oil as a substitute for

water for the carriage of wastes. Disposal of the slurry would be provided by burning in the standard heaters or boilers used for heat, hot water, cooking or sterilization. Research on the feasibility of this method is presently under way in the Civil and Mechanical Engineering Departments.

The low density and viscosity of the oil under arctic conditions raises the problem of the transportation of slurries in oil. The additives

It is proposed to use standard tank-type closets having a minimum of flushing liquid. Where batteries of such toilets are used, a single homogenizer or grinder will provide the necessary emulsification; the oil slurry will be pumped to the heating units. It is a basic concept in this method of disposal that no additional fuel oil will be

required above that normally provided for heat or power. Difficulty has been experienced with the gas-kets and other fittings in standard toilets but these can be modified without undue complications.

Investigation is also being made of the possibility of using flexible-type piping for all plumbing connections as this would offer con-

siderable advantage. Studies are now under way in the use of both plastic pipe and metallic hose.

These studies are being supported by the Arctic Aeromedical Laboratories of the United States Air Force. Work in the Mechanical Engineering area is under the direction of Professor Edward F. Obert.

OXIDATION STUDIES

The Pennsylvania State University

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and

JOHN B. NESBITT,

Assistant Professor of Civil Engineering,
The Pennsylvania State University

THE PRESENT major sanitary engineering research activity at The Pennsylvania State University deals with studies of metabolism in biological oxidation using activated sludge. One project (directed by R. R. Kountz) is investigating "total oxidation," and the other (directed by J. B. Nesbitt) is evaluating the biological oxidation of cyanides. Both projects are supported by grants from the National Institute of Health.

Total Oxidation. In this study it is assumed that total oxidation means that the influent substrate is converted to new activated sludge solids and that at the same time all

Table 1—Typical Values in Total Oxidation Equilibrium³

	Pounds per 24 hours	
	Influent	Effluent
Skim Milk Powder	1.67
Organic Nitrogen	0.088	0.015
Nitrate Nitrogen	0.000	0.074
Cells (activated sludge)	0.123 ¹
BOD (5 day, 20°C)	0.16	0.016
Carbon	0.665	0.680 ²

¹Suspended solids; 50 mg/L.

²Measured as respired carbon dioxide.

³Activated sludge weight: 20 lbs.

Influent and effluent rate: 264 gallons/24 hours.

Aeration period: Six hours.

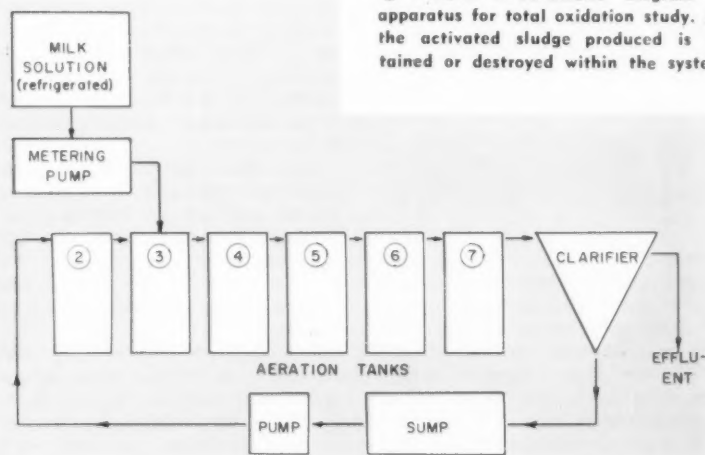
No measurable values were obtained for ammonia or nitrite nitrogen.

of the activated sludge organisms destroy and assimilate themselves. The desired net effect is to have the activated sludge destroy its own weight equivalent to the weight of new activated sludge being produced from the influent. When this growth-and-destruction equilibrium occurs

treatment will take place, and there will be no need to remove and to dispose of excess activated sludge from the process.

This theory of biological oxidation was first proposed by Hoover, Porges, et al., of the U. S. Department of Agriculture, which agency subsequently sponsored a pilot plant project at Penn State to verify their theories when applied to dairy wastes. The first pilot plant operated as a batch-type process (five days per week) which suggested the possibility that the "resting periods" permitted the self-oxidation of the activated sludge to occur. Therefore, the second, present project was designed as a continuously-fed total oxidation unit with the intent of eliminating the resting period factor. Also, any pilot plant which is located at an operating industry (dairy), as the first one was, has to contend with all of the irregularities and upsets associated with "normal operation." Such variations in influent quality are not conducive to obtaining data suitable for use as basic design factors.

● **FIGURE 1.** Schematic diagram of apparatus for total oxidation study. All the activated sludge produced is retained or destroyed within the system.



When basic design factors are available, then a pilot plant or full scale plant should be built. In either case, for optimum economic investment, the plant should be designed, applying probability theory, to treat the waste that is calculated to be typical for 95 percent of the time; not for every day nor for the "average" waste.

The "total oxidation" project utilizes six one-hour aeration tanks operating in series, followed by a clarifier (Figure 1). The sludge is removed regularly from the clarifier and is returned to the aeration tank series, so that all of the activated sludge is kept in the system all of the time. The influent is a solution of skim milk powder and is pumped in continuously, twenty-four hours per day.

Each aeration tank is analyzed for carbon dioxide escaping with the

The sludge in the aeration system is examined for biological stability by determining its oxidation rate (k -value) by means of BOD tests. These data have shown the sludge to be very stable as k -values of less than 0.01 have been obtained when the sludge concentration (mixed liquor solids) was approximately 6,000 mg/L. Equilibria achieved under these conditions show the weight of activated sludge in the system to be 12 to 15 times the daily influent weight of total volatile solids. Thus in designing such a system, the engineer can vary the volume of the aeration unit and obtain most any activated sludge concentration desired.

In Table 1, on the previous page, typical values for the various components involved in the total oxidation equilibria are listed in terms of pounds of the respective com-

out the odors peculiar to digestion and sludge processing. Some of the principles of this research have already been seen in small proprietary plants used for treating the wastes from housing groups, schools and factories. When all of the details of total oxidation are known and assembled, they can be applied and economically evaluated for any size of sewage or waste treatment plant.

Biological Oxidation of Cyanides.

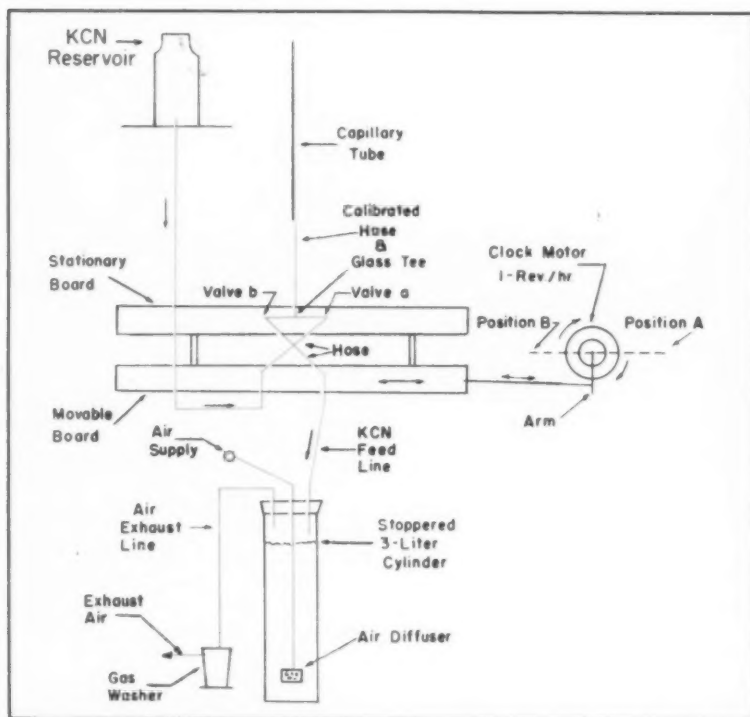
Some years ago, Pette of the British Water Pollution Research Laboratory observed cyanide oxidation on a trickling filter. The English reports included no parameters for evaluation of metabolism or design in an activated sludge system and, therefore, a research project was established at Penn State for this study.

Activated sludge cultures were developed first using domestic sewage. The cultures were then slowly converted to those which would exist on an influent containing potassium cyanide as their source of food. Preliminary results indicate that five to twelve pounds of this activated sludge can assimilate and decompose one pound of cyanide per day; however, growth of the organisms on this diet is extremely slow. Data so far indicate that the cyanide nitrogen is oxidized to ammonia, nitrites and nitrates, and the cyanide carbon to carbon dioxide.

The cyanide oxidation is performed in three-liter glass test tubes located in a constant temperature (72°F) water bath (Figure 2). A clock mechanism meters and adds the cyanide solution once each hour to the aerated test tube cultures. Once each day the tube contents are allowed to settle and a liter of supernatant is removed, and this volume is replaced with water. The excess air escaping from the tubes is scrubbed in a gas washer in order to trap and measure any cyanide and/or ammonia which may have been sparged from solution. Appropriate analyses are made each time the supernatant is removed in order to obtain solids and chemical balances in the system.

At present, two three-liter cylinders are in operation and are being fed 60 and 120 mg CN⁻ per day. During normal operation no CN⁻ has been detected in the supernatant of either cylinder. Less than 0.5 mg/day is sparged from each cylinder.

It is proposed to extend this work eventually to include some organic cyanides as well. In all, it is hoped to secure data which can be used in the design of an industrial waste treatment plant.



● FIGURE 2. Flow diagram of the batch testing apparatus used for studying the oxidation of cyanides. Clock motor adds and meters KCN solution each hour.

excess air. The amount of carbon dioxide is an indirect measure of the oxygen required in the waste purification phase and in the sludge oxidation phase. The effluent is analyzed for all forms of nitrogen (organic, ammonia, nitrite and nitrate) in order to obtain a balance against the protein entering in the influent.

ponents per 24 hrs. found in the influent and effluent. The reduction in values of organic nitrogen and BOD and the increase in that of nitrate nitrogen may be noted.

Obviously, such a type of treatment plant is cheaper to construct and simpler to operate than conventional types. In addition, since it is an aerobic process, it operates with-

The EFFECT of MONOCHLORAMINE and CHROMATE on BACTERIAL CHROMOSOMES

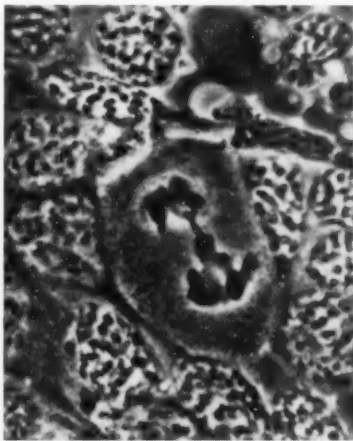
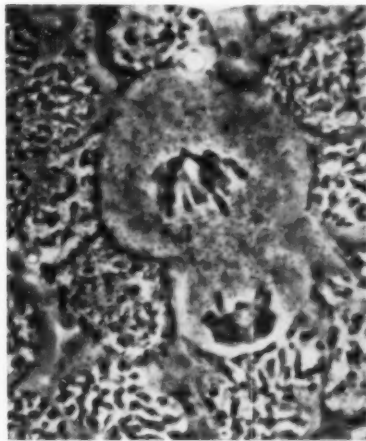
Georgia Institute of Technology

ROBERT S. INGOLS,
Research Professor,
Engineering Experiment Station,
Georgia Institute of Technology

WITHIN a joint project of the Engineering Experiment Station and the Department of Applied Biology at the Georgia Institute of Technology, research work is in progress concerning the mechanism

contact. The present research on this problem indicates that after organisms have been grown in nutrient broth, the bacterial suspension following chlorination shows no difference in numbers when the chlorine is removed by cysteine or thiosulfate. However, when the organisms have been grown on nutrient agar, then the cysteine brings about a markedly larger

examined under the microscope. Thus, it can be shown that monochloramine reacts as a radiomimetic material producing a number of chromosome aberrations in plant and animal cells when these cells are left in solutions of monochloramine for a brief period of time. The change in the nuclear material was not expected for it indicates that enough of the monochloramine en-



● **FIGURE 1.** Cells examined under the microscope indicate normal and abnormal division. At the left is a normal plant cell; center is a plant cell with chromosome aberration during

mitotic division; and at right is an animal cell with the nucleus divided into three parts after the cell had been in contact with a monochloramine solution for a fairly short period of time.

of the action of monochloramine upon bacteria. This work is being aided by the observation of the biology group within the Engineering Experiment Station that monochloramine behaves as a radiomimetic chemical.

The study of the mechanism of bactericidal properties of chlorine has developed a number of interesting and surprising features. Several years ago information was published from this laboratory which indicated that following contact with monochloramine, cysteine was effective in producing a larger number of surviving organisms than thiosulfate. Other workers have reported that they could detect no difference in the activity of cysteine and thiosulfate following chlorine

number of surviving organisms over those that are obtained by the use of the thiosulfate or sulfite as the dechlorinating agent. These tests have been repeated many times with similar results. These same relationships have been observed whether the organisms are grown on agar in the presence or absence of oxygen. The organisms grown on agar are generally more susceptible to chlorine than those grown in broth. Those grown in an atmosphere of nitrogen are apparently more susceptible to chlorine than the organisms which were grown in an atmosphere of air or oxygen.

Another phase of the study with monochloramine has shown that this chemical damages the reproductive mechanism of cells which can be

tered the cell to react with the nuclear material rather than all of the monochloramine having reacted at other sites in the protoplasm such as the cell membrane or the adjacent protoplasm.

Why should the development of chromosome aberrations be a matter of importance in sanitary engineering? Because many chemicals known to be carcinogenic are also known to produce chromosome aberrations, it is the general conclusion of our laboratory that it should be very desirable to maintain the lowest possible concentration of monochloramine in the drinking water of a city. While the chance of creating abnormal cells by contact with monochloramine from drinking water is extremely

small, it is felt that the chance for development of these abnormal cells from environmental changes is constantly increasing. Dangers from radiation fallout are increasing daily; therefore, care should be taken to control those chemicals which can produce changes similar to radiation. It is thought that radiation in addition to chemicals can become a sizable problem over a period of years.

Chromate Ions

It has also been observed that the presence of chromate ions brings about similar development of chromosomal aberrations in plant and animal tissue when the chromate ions are present even in extremely small or low concentrations. These ions are found in soluble form in many industrial wastes which can discharge into potable water supplies. Because this chemical may be present in drinking water, a knowledge of its effect upon various biological forms is considered highly important. It has been observed that

the toxicity of chromate is much greater toward bacteria than toward either fungi, such as yeast, or against protozoa. This greater toxicity of chromate has been interpreted as the result of the chromate ion having a greater effect upon the genetic mechanism of chromosome materials in the bacteria than it has in the yeast. This higher toxicity toward bacteria is not simply a result of the cells of the bacteria being smaller, but is dependent upon the fact that these yeast cells studied by us are diploid, having two sets of chromosomes, while bacterial cells are haploid, having one set of chromosomes. Therefore, when one chromosome fails to develop an essential enzyme because of the reaction of a chemical or radiation in a bacterial cell then both the daughter cells are dead. It is well established that diploid organisms are much less sensitive to genetic damage than the haploid organisms. The effect of chromate upon the reproductive mechanism of the cells (as can be

observed under the microscope) and the indirect indication of this effect by a study of the respiratory ability and the reproduction of bacteria indicate to the workers in this laboratory that, to reduce the hazard of the development of cancer, the lowest possible concentration of radiomimetic chemicals, such as chromate, should be maintained in potable water supplies.

A possible useful by-product of the observations on the effect of chromate upon bacteria and fungi may be illustrated by plating sewage in an agar medium with sugar. Ordinarily the tremendous numbers of bacteria in sewage grow so rapidly that the fungi are unable to develop on the agar medium in spite of the fact that originally the medium favors their growth. By adding 500 mg/L of sodium chromate to the medium the development of bacteria has been prevented but not the development of the fungi. This differential medium for fungi should be a help in the counting of fungi in soils or sewage.

DISINFECTION of SEWAGE SLUDGE BY HALOGENS

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SEWAGE halogenation experiments were undertaken as an approach to studies of the limiting influences of suspended solids and nitrogenous material in the disinfection of sewage and sludge. This approach, halogenating sludge instead of secondary effluents, was chosen as affording more readily measurable effects of variations in concentration and in states of dispersion of suspended solids. It also permitted measurement of forms and concentration of accompanying nitrogenous materials.

It was early observed that, with the aid of homogenization of sludge, doses of 4 to 6 mg of chlorine per 100 mg of solids readily reduced the

density of coliform bacteria to fewer than 100/100 ml. It therefore seemed plausible to explore the limits of the colicidal action of available halogenating agents with respect to primary sludge over wide ranges of solids concentration and degrees of homogenization.

Experimental Procedures. Sludge samples of comparable freshness and composition were obtained from a well operated 1-mgd primary settling tank of the Lamarque, Texas, treatment plant at the regular 4-hour sludge withdrawal intervals. Test portions were adjusted to the desired solids concentrations by thinning the samples with the sewage liquor found immediately supernatant to the thicker sludge in the tank. Halogenating solutions were prepared from gaseous chlorine, liquid bromine, iodine-iodide solution, 10 percent commercial sodium hypochlorite solution, and calcium hypochlorite powder (70 percent

available chlorine), with tap water as the diluent in each case. Homogenization was effected by means of a Waring Blendor operating at 13,000 rpm.

The reduction of the concentration of coliform organisms to below 100/100ml during a 2-hour halogen contact period, with samples mechanically stirred just sufficiently to prevent excessive subsidence of solids, provided an arbitrary index of colicidal effectiveness. Physical and analytical observations included color, physical appearance, settling characteristics, sulfide content, pH, alkalinity, chloride, albuminoid ammonia, total nitrogen and total and volatile suspended solids. Additional observations were halogen dosage, demand and residuals, including soluble residual and residual demonstrably associated with the suspended solids; and MPN of coliform bacteria by multiple dilution technique.

Significant Observations. Maximum observable benefits from the standpoint of disintegration were realized within 2 minutes of homogenization for solids concentrations up to approximately 2 percent, and within 6 minutes at 5 to 7 percent solids. No demonstrable colicidal effect resulted from the disintegration of the solids.

Chlorination of non-homogenized samples readily reduced the coliform organism density, but when such samples were homogenized, after dechlorination, much higher numbers of organisms were present. Over a wide range of suspended solids concentration it has been shown that destruction of coliforms is much more readily attained in homogenized samples, bearing out the long time assumption that organisms are protected by clumps of solids, limiting total disinfection of sludge and of raw and settled sewage.

The colicidal effectiveness of all five of the halogenating agents has been compared only at sludge solids levels below about 1 percent. Two hour bromine residuals of 0.125 to 0.25 milli-equivalents per liter (me/L) as compared with about 0.5 me/L from the other agents consistently reduced coliforms below 100/100 ml. But the dosage requirements, on a chemical equivalent basis, were two times greater for bromine than for chlorine and about three times greater for iodine than for the hypochlorites.

At sludge solids levels of about 5 percent, the required 2-hour residuals for chlorine were 2 to 4 me/L; for calcium hypochlorite, 6 to 8 me/L; but for sodium hypochlorite, less than 1 me/L. The dosage requirement of sodium hypochlorite, based on grams of equivalent chlorine per 100 grams of sludge solids, was also shown to have an advantage. Effective doses for the three agents were 4 to 5 g for sodium hypochlorite, and 6 to 7 g for chlorine and calcium hypochlorite.

Total kill of coliforms in non-homogenized sludge has been attained at slightly higher doses of chlorine and sodium hypochlorite than were required of homogenized samples. But doses of calcium hypochlorite as high as 12 g per 100 g of sludge solids were ineffective. The colicidal effectiveness of the required doses of chlorine and sodium hypochlorite, respectively, are in part attributable to the resultant low and high pH values.

A total kill of coliform organisms has been effected in nonhomogenized sludge of high solids content

at sodium hypochlorite doses slightly greater than those required for homogenized samples. Effective colicidal action also has been attained with very high doses of chlorine, but the ultimate effect is attributable in part to the resultant low pH. Reduction of coliforms to below 100/100 ml in non-homogenized sludge has not been effected with calcium hypochlorite by doses as high as 100 mg per 100 mg of solids.

Evidence has been obtained that the presence of suspended solids limits bactericidal action not only by the heavy chlorine demand and the physical protection of organisms, but also by tying up a chemically measurable residual in forms of chlorine or other halogens having very low bactericidal activity or availability. This is quite pronounced at suspended solids levels above approximately 1 percent, when the resultant pH is 7 or lower. It is held that this is a major limiting factor in the disinfection of sewage sludge with chlorine or calcium hypochlorite but is of no consequence in disinfection of raw sewage with any of the three chlorinating agents.

Interesting relations being studied include rates of demand, dosage-demand relations, demand associated with solids as compared with soluble components, and demand accounted

for by sulfide and by nitrogenous material. Two somewhat axiomatic observations are: (1) The necessity for satisfying demand sufficiently to establish certain time-residual requirements is most pronounced; (2) at effective and super-effective residual levels in samples having more than approximately 0.5 percent suspended solids, the major portion of the demand is attributable to the solids.

Continuing Studies. Current experiments include chlorination of activated sludge, in which results indicate that dosage and residual requirements are of the same order as for primary sludge. Chlorination studies are being extended to sewage and sewage effluents with emphasis on observing limiting influences of accompanying solids and nitrogenous materials upon bactericidal rates and total kill.

Acknowledgment. These studies have been supported in part by a research grant from the National Institutes of Health, U. S. Public Health Service, and in part by the James W. McLaughlin Foundation, University of Texas Medical Branch.

References

1. Connell, C. H., Dreyer, D. A., and Berg, E. J. M., "Reduction of Coliform Bacteria in Sewage Sludge by Halogens." *Sewage and Industrial Wastes*, 30, 5, 634 (1958).



● SLUDGE samples chlorinated with incremental doses. The samples are stirred just sufficiently to prevent excessive subsidence during a two-hour contact period.

RESUSPENSION of SOLIDS in SEDIMENTATION BASINS

California Institute of Technology

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and

A. C. INGERSOLL,

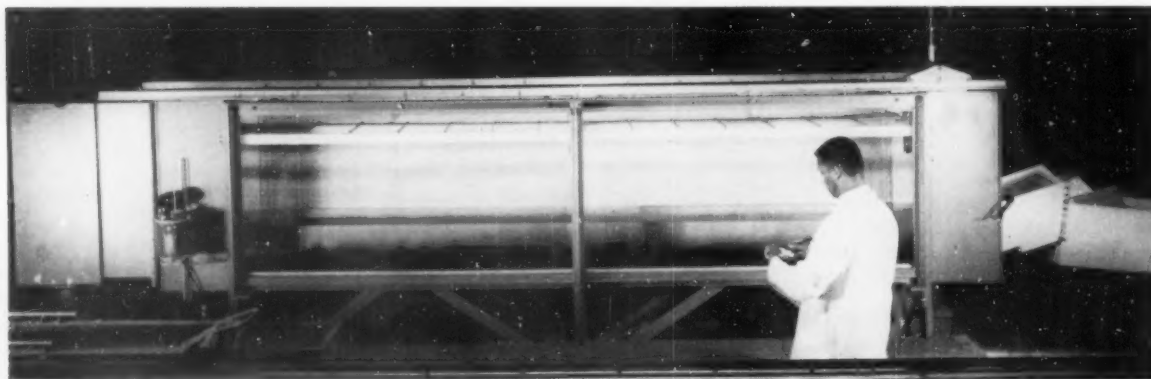
California Institute of Technology

WHAT IS IT that makes one settling tank produce a clearer effluent than another when both are receiving exactly the same influent suspension? For years engineers have been trying to answer this question and to apply the answer to

perfect operation of a sedimentation basin.

A comparative newcomer to this family is the phenomenon of resuspension, thought to be observed first in a rectangular primary settling tank in the Los Angeles area. This tank was operated only at periods of peak flow in a nearby sewerage system. Each day, therefore, the flow through the tank was increased from zero to a maximum for the day. The

Two basic modes of resuspension are discussed hereinafter. In one case the velocity over a settled bed is increased slowly and, when a certain critical velocity is reached, the bed commences to be picked up or resuspended. In the other less obvious case, the velocity over the bed remains constant but, as the bed builds to some critical thickness, it becomes resuspended in similar fashion.



● FIGURE 1. Flume used in the resuspension studies is equipped with a tail gate at the left to permit varying water depth.

the design of settling tanks. Their first rational approach, derived from the old fill and draw technique, was to base behavior and design on detention time, and many state health departments still use this criterion. Later, the overflow rate gained popularity as the most important single design criterion. This is especially true in the design of grit chambers for discrete suspension. In this case the ratio of the mean settling velocity of the influent suspension to the overflow rate, called the Hazen Number, has become the principal criterion.

Turbulence generated either from wall and floor friction or from residual excess kinetic energy at the inlet; bed scour; short-circuiting; sludge removal devices; flocculation; draft from effluent weir or launder—all of these have been recognized as contributors to the im-

perfect operation of a sedimentation basin. A comparative newcomer to this family is the phenomenon of resuspension, thought to be observed first in a rectangular primary settling tank in the Los Angeles area. This tank was operated only at periods of peak flow in a nearby sewerage system. Each day, therefore, the flow through the tank was increased from zero to a maximum for the day. The

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This problem has appeared sufficiently important and challenging to the Public Health Service to warrant a research project at the California Institute of Technology.

Plant Studies. The first tests involved two of the primary settling tanks of the Los Angeles County Sanitation Districts' Joint Plant. One tank was provided with transverse baffles spaced at 4-ft. intervals. The results of settleable and suspended solids tests showed that the baffles behaved more as obstructions to flow, generating turbulence instead of quieting it. Apparently they were too widely spaced. The possible merit of more closely spaced baffles for inhibiting resuspension will be studied during the project.

Bed Scour Studies. In order to study the resuspension phenomenon under controlled conditions, laboratory tests are being conducted in

the flume shown in Figure 1. The flume has a working section 15¼ in. wide and approximately 15 ft. long. By means of a sloping tail gate, the water depth can be varied from about 0.2 ft. to about 2.5 ft. The water is metered and supplied to an inlet box from which it passes through a perforated-plate baffle to the glass-walled working section returning finally to the supply for recirculation.

The flume has several features designed especially for the study of resuspension. The floor of the working section consists of a layer of false floor sections. These can be removed allowing a movable bed up to ¾ in. thick to be placed at any point in the floor. For the study of the effect of sludge-scraping equipment, a mechanical system of flight scrapers moving in an endless train has been installed. The flights have a height of ½ in., a spacing of 10 in., and move at 0.428 in. per sec. The flume has also been fitted with a slurry mixing vat for the continuous introduction of the suspension in the influent end of the tank and a sludge removal hopper, also located at the influent end.

Before the problem of resuspension could be attacked, it was necessary to learn more about the problem of initial entrainment from a stationary bed of particles. Consequently, a study was made of critical bed shear and its relation to bed

Reynolds number. For each of several different kinds and sizes of bed materials, a series of runs was conducted for the determination of critical bed shear. A smooth bed several particles in thickness was laid in still water for each run. In order to determine the effect of turbulence from inlet conditions, beds of varying length were laid at various distances downstream from the inlet. During a run, the displacement velocity was slowly increased until a small fraction of the particles began to roll on the bed. As the velocity was increased further, some of the particles began to bounce and hop along while others nearby (and presumably of similar size and shape) scarcely moved on the bed. For this reason it was difficult to determine the critical velocities precisely. Still another difficulty occurred with beds of flocculent particles. In this case the time elapsed between the laying of the bed and the beginning of a run was important; the bed became more stable with time. Despite these complications, the following conclusion could be drawn: For discrete suspensions of low density particles (sp. gr. 1.04), the beginning of bed-load movement occurs at much lower values of bed shear than would be anticipated from the classical bed-load experiments using sand grains.

In addition to tractive shear forces at the sludge bed, the configuration

of the bed and motion of the sludge scrapers have an important effect on the resuspension in a settling tank. Therefore, a series of experiments is being conducted with sludge scrapers in motion. Before each run a smooth bed of discrete gilsonite particles (sp. gr. 1.104) is laid on the floor of the flume while the water and scrapers are still. During the run the displacement and scraper velocities are held constant while the quantity of particles passing out with the effluent and that passing through the sludge hopper are measured as functions of time. The velocity and spacing of the scrapers has been the same for all runs.

From these experiments it has been found that the volume of material in the sludge bed affects the relationship between the displacement velocity and the time rate of resuspension (e.g. gm per min). In addition, it has been observed that the bulk of the resuspension takes place at the tops of the mounds of particles being pushed by the scrapers; the resuspension increases with the size of the mounds.

This series of experiments will include runs with other sizes and types of particles. In the near future, these resuspension experiments will be made more comprehensive by injecting suspended particles into the flow at the upstream end of the flume.

The ROLE of ALGAE in POLLUTION ABATEMENT

The University of Michigan

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WITHIN the larger problem of water quality and its control, the role of algae in the stabilization of treated sewage is a factor of significant but undetermined proportions. Sewage effluents, regardless of degree of treatment, contain fragments of the original waste components. Thus, after successive uses a stream may become degraded even though the latest technological

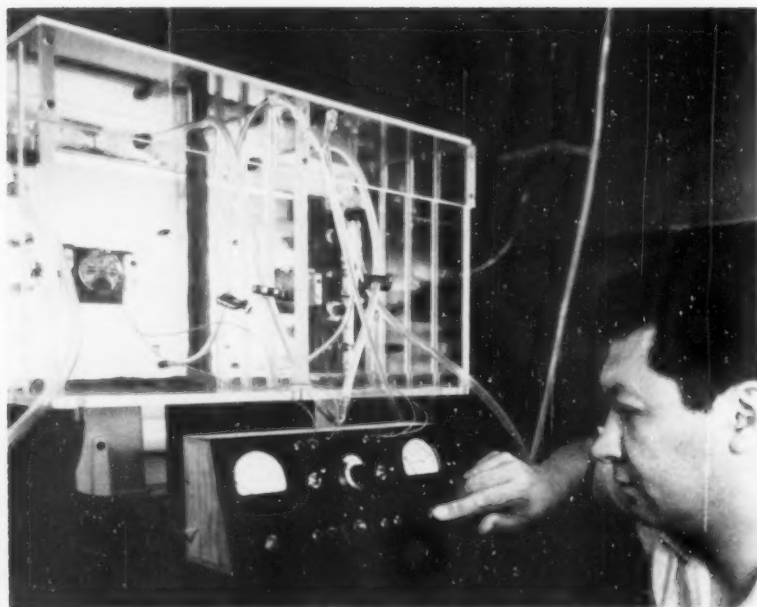
developments in the treatment field are employed. Natural rehabilitation of such polluted waters may subsequently take place, but the process is slow.

What part do the algae play in this natural recovery? At what rates do they metabolize waste components, and under what conditions? If a basic understanding of this phenomenon could be acquired, an algal culture might be adapted to grow within the confines of our sewage treatment plants. With this additional process, it might be anticipated that a great deal of the

present nutrient load could be removed from our receiving waters and this capacity reserved for other uses and for additional growth.

For the past two years, the University of Michigan Sanitary Engineering Laboratory has been working extensively with uni-algal cultures under controlled conditions in an attempt to reach a fundamental understanding of the mechanisms involved in stabilization of waste waters.

It was necessary rather early in the experimental work to devise adequate methods for enumeration



● LIGHT intensity, temperature, substrate, and type of organism are some of the environmental factors affecting algae study subject to control by special equipment.

of numbers and size of organisms within the cultures being studied. A great deal of this work was done with an inverted scope which greatly simplifies the concentration problem. In this device, a 100 mg. sample of water is treated with formalin and the dead organisms are allowed to settle to the bottom. The container is viewed from the bottom through the scope, and as many fields as required may be counted quickly by means of a hand counter. This device gives a direct measure of total count. Blood counting cells have also proven very convenient for making counts and determining size.

Light intensity has proven to be a very critical quantity in obtaining reproducible growths of typical cultures. Rate of growth appreciably increases with increasing light intensity within a given range. When an algal suspension is studied under batch conditions, light intensity varies due to the interference of the increasing number of organisms to the passage of light through the medium. Thus, quantitative results regarding any environmental factor must have the effect of variable light intensity superimposed over the observed results. This makes interpretation of data rather difficult, and has resulted in the construction of an experimental device which will maintain a constant light intensity for the duration of an experiment. The device also permits varying temperature, light, sub-

strate and type of organism, as well as other environmental factors. The equipment is so designed that with an increase in number of organisms, and a subsequent interference to the passage of light through the leucite growth cell, a dilution of the substrate and the removal of the newly formed cells is effected. A curve of growth against time is automatically drawn. It is hoped that quantitative design data can be obtained by the use of this equipment, which will permit the adap-

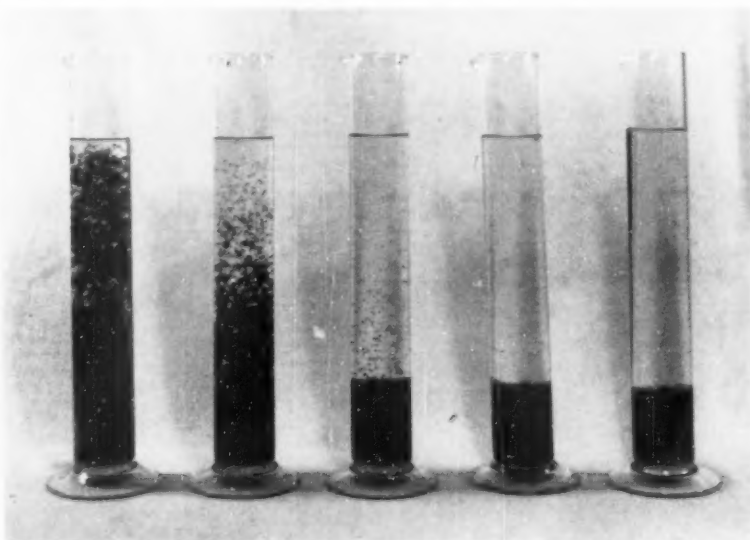
tation of some type of algal culture as a tertiary step in the sewage treatment process when such becomes necessary.

Research by others on sewage lagoons^{1,2,3} has indicated information currently available on the use of *Chlorella*, *Scenedesmus*, *Ankistrodesmus* and related forms. These organisms, while active and easy to culture, are very small, measuring but a few microns in their largest dimension. Their use in a modern type of sewage treatment tank would be predicated on the fact that they could be easily removed from the treated waste. This presents a problem which has many ramifications. Current experiments within this laboratory range from filtration through centrifuging to the cultivation of antagonistic forms.

One solution to the problem of removal is to utilize a type of algae which will form flocculent masses similar to those formed by *Zooglea ramigera* in the activated sludge process. Such an algal culture could be removed easily by sedimentation. Several organisms seem to respond well when treated as though they were activated sludge.

References

1. Gotaas, H. B. and Oswald, W. J., "Algal-Bacterial Symbiosis in Sewage Oxidation Ponds," *Third Progress Report*, Inst. of Engr. Research, University of California, Berkeley, Calif.
2. Renn, Charles E., "Algae Research on Oxidation Ponds," *Am. Jour. Pub. Health*, 44, 631 (1954).
3. Ryan, William A., "Industrial Waste Lagoons," *Sew. and Ind. Wastes*, 22, Jan. (1950).



● RAPID agglomeration of algae suspensions is demonstrated by filling the graduates at one-minute intervals and taking the photo a minute after the last filling.

DETERMINATION of RADIOISOTOPES in WATER, FOOD and SEWAGE

Wayne State University and Robert A. Taft Sanitary Engineering Center

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THE DETONATION of atomic weapons, the widespread use of radioactive isotopes, and the development of nuclear reactors have given rise to a new contamination problem. Contamination of the environment with radioactive substances may arise from radioactive fallout from nuclear weapons, by discharge of radioactive isotopes into the sewerage system, by failure of a nuclear reactor, or from naturally occurring radioactive materials. Some of these radioactive contaminants eventually find their way into water used for drinking purposes and into certain foodstuffs. It is important, therefore, to have methods available for the detection and identification of these radioactive contaminants.

The toxicity of radioactive substances varies greatly between isotopes. In general those with a long half-life and which are readily assimilated and retained by the body are considered the most hazardous. In this class one finds strontium-90 and naturally occurring radium. Those of short half-life which are rapidly excreted from the body are less hazardous. Examples of these are sodium-24 and phosphorus-32. A compilation of the various radioactive substances and the maximum permissible concentrations allowable in water is given in National Bureau of Standards Handbook 52¹ and in foods in the Federal Register.² The development of rapid and accurate methods of analysis for the determination of various radioisotopes in drinking water and in foods is the subject of intensive research at the Robert A. Taft Sanitary Engineering Center and the Chemistry Labora-

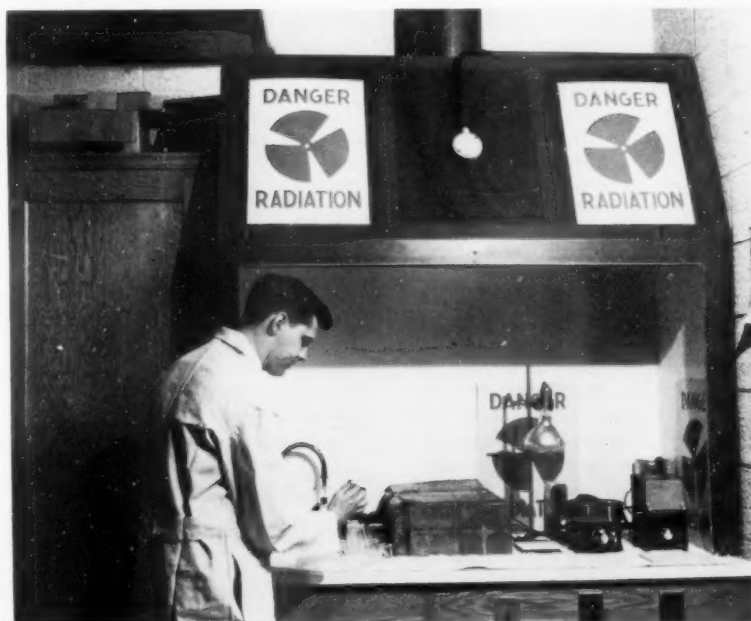
tory of Wayne State University.*

A brief summary of this research is given in the following paragraphs.

Water Analysis. The permissible amounts of radioisotopes in water are so small that ordinary methods of chemical analysis are useless; hence, a radiochemical procedure must be used. In this method a known amount of non-radioactive form of the isotope is added as

measured using a suitable device, such as a Geiger tube and scaler or scintillation counter.

A difficulty associated with water analysis arises from the very low level of radioactivity which must be detected. In order to obtain a detectable amount of activity, several liters of water must be taken as a sample, and the radioactive substances concentrated into a small



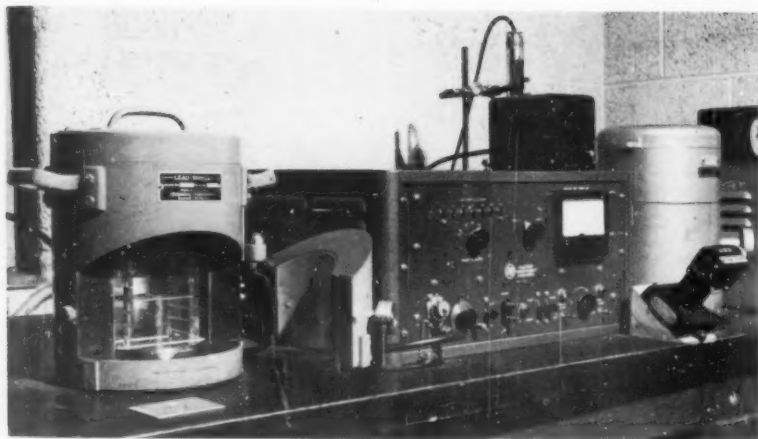
● STUDENT checking a new procedure by adding a known amount of a carrier to a radioactive sample. The carrier aids in the analytical separation of radioisotopes.

“carrier.” For example, to analyze a sample for radioactive strontium, a known amount of inactive strontium nitrate is added. The carrier along with the radioactive isotope is subjected to chemical treatment which serves to separate the desired constituent and carrier from other radioactive substances and interfering ions. A pure product is finally isolated and the radioactivity is

volume. Two methods have been employed to concentrate the activity—precipitation and ion exchange.

Precipitation techniques are the most successful. In this procedure the activity is collected in a suitable precipitate which is allowed to settle from a large-sized water sample. The water is then decanted and the precipitate is subjected to radiochemical analysis. Ion-exchangers have been used also to concentrate radioactive substances from water. A large-sized water sample is passed through a suitable exchange column

*The Work at Wayne State University was supported in part by a grant from the National Institute of Health.



● APPARATUS for measurement of radioactivity in samples in the Radiochemistry Laboratory at Wayne State U. Water samples are concentrated and "counted."

and the desired activity is then selectively eluted from the column.

At Wayne State University procedures have been developed for the determination of radioactive cerium, cobalt, iodine, niobium, phosphorus, ruthenium, and zirconium. Procedures for the more hazardous radionuclides in water have been developed by the Robert A. Taft Sanitary Engineering Center and include the identification of total strontium, strontium-90, yttrium, barium, cesium, and soluble radium. Since the usual methods of sample processing would result in the loss of the volatile tritium, special processing and use of liquid scintillation counting techniques are required. Because of the high salt

content of marine and estuarine waters modified procedures have been or are under development for the specific radionuclides mentioned above.

Sewage Analysis. Many users of radioisotopes dispose of them into the sewerage system. If radioactivity is detected in the effluent from a treatment plant, the operator should know which isotope is causing the activity in order to evaluate its hazard and to determine if it is safe to discharge the effluent. A radiochemical analysis is required.

In the laboratories of Wayne State University procedures have been developed for the determination of various isotopes in sewage effluent. The general procedure consists in

digesting the effluent with sodium hypochlorite to destroy organic matter, then using the same procedures as in the analysis of water.

Food Analysis. The analysis of foods for radioactive contaminants is more difficult than the analysis of water and sewage. All organic matter must be destroyed before a radiochemical analysis can be performed. This is accomplished by dry ashing (burning) the sample in a muffle, then dissolving and analyzing the residue by radiochemical procedures.

Milk from ten sampling areas is collected monthly and shipped to the Robert A. Taft Sanitary Engineering Center as a part of a milk radiation surveillance network operated by the Public Health Service. Upon receipt, the fluid milk is analyzed for iodine-131 and cesium-137 by gamma spectroscopy. It is then ashed and radiochemical separations are performed to identify strontium-89, strontium-90, barium-140, and cesium-137. Stable calcium is determined and the potassium-40 concentration is calculated from the stable potassium which is measured by flame photometry.

References

1. "Maximum Permissible Amounts of Radioisotopes in the Human Body and Maximum Permissible Concentrations in Air and Water." Handbook 52, National Bureau of Standards. Washington, D. C. (1953).
2. Federal Register, 22:19 (January 29, 1957). Title 10. Atomic Energy. Chapter 1. Atomic Energy Commission, Part 20. Standards for Protection Against Radiation.

DISPOSAL OF DEWATERED FRESH SEWAGE SLUDGE

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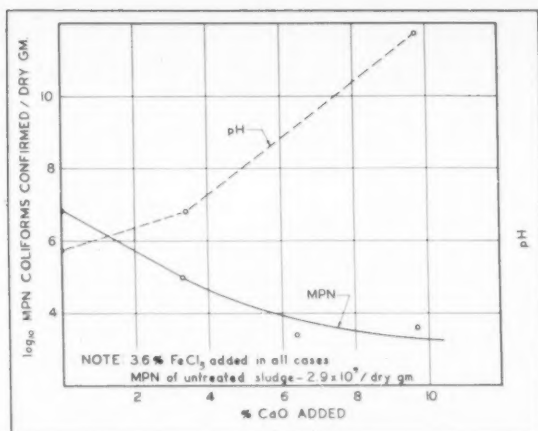
IT HAS BEEN said that the sanitary engineering profession has to a high degree developed methods of separating solids from liquids in sewage treatment, but that there is still much to be desired in disposal of either of the two components

after the separation has been effected. Although this statement is an over-simplification, an appraisal of methods of sludge disposal indicates the need for improved efficiency.

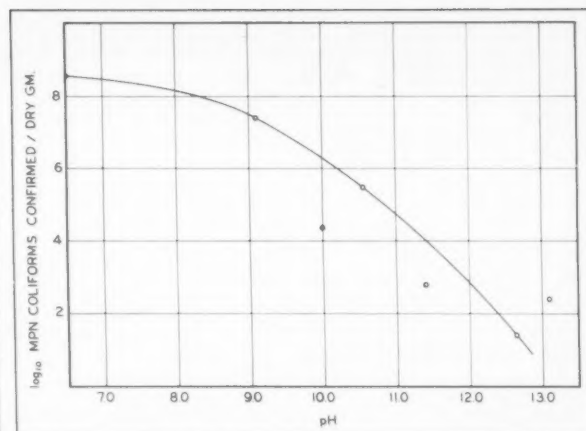
An effective method of sludge disposal must meet the following requirements: (1) Low installation cost; (2) economical operating costs; (3) ease of operation; (4) absence of nuisance; and (5) freedom from pathogenicity.

The dewatering of fresh sludge has been practiced since 1925, albeit in many instances with some reservations. Fresh sludge dewatering as a unit process of disposal has been shown to satisfy the first four of the requirements listed above.⁵ With standard chemical conditioning, dewatered fresh sludge does not produce odor nor other nuisance problems.

The potential pathogenicity of dewatered fresh sludge is a factor that



● FIGURE 1. Lime dosage in the conditioning of sludge affects pH; an increase reduces coliform organism MPN.



● FIGURE 2. Conditioning of sludge to a pH of 11 to 12 is normally practiced in dewatering; lowering of MPN is result.

has not been previously investigated, except for an occasional brief study. Investigations were therefore instituted at the Komline-Sanderson laboratory as well as at the University of Missouri, to determine the degree of potential pathogenicity in filter cake produced from the dewatering of fresh sewage sludge. In view of the correlation that has been shown between the most probable number of coliform organisms, and, for instance, the incidence of *Salmonella*,² the fate of coliforms as measured by MPN was chosen as an index in the preliminary study.

With raw sludges containing MPN counts on the order of 10^7 to 10^{10} organisms per dry gram, dewatered filter cake from the sludges had coliform counts ranging between 0 and 10^4 per dry gram. Since it has been determined that all surviving coliforms are found in the filter cake, with zero counts in the filtrate, these reductions, resulting from the conditioning and dewatering of the sludge, represent very high coliform kills.

The toxic effects of high pH, and of ferric chloride on sewage organisms, including coliforms, have been known for some time.^{3, 4} Since lime and ferric chloride are widely used standard reagents in the conditioning of most sludges for dewatering, it is to be expected that great reductions in the numbers of these organisms would ensue from the chemical conditioning of sludge, especially as a result of a high pH induced by the lime.

A typical example of the effect of pH is shown in Fig. 2. Conditioning of the sludge to pH of 9.0 or higher results in accelerated reduction in the numbers of coliforms. Beyond pH 11.0 the coliform density is reduced to an order of magnitude not ex-

ceeding 10^3 . Since most sewage sludges are dewatered within the pH range of 11.0 to 12.0, it can be expected that a properly conditioned dewatered sludge, whether it be fresh or digested, can be disposed of with minimum possibility for the spread of pathogenic organisms.

The comparative roles of the conditioning chemicals in reducing coliform numbers are shown in Table 1 and Figs. 1 and 2. The addition of 3.6 percent ferric chloride, without lime, reduced the coliform density from 2.9×10^9 to 7.1×10^6 . The addition of lime in varying quantities, with the same dosage of ferric chloride, effected further coliform reductions.

Variations in ferric chloride dosage, with a constant lime addition, show an interesting phenomenon.

Table 1—Effect of FeCl_3 Dosage on Coliform Count in Dewatered Fresh Sludge

% FeCl_3 Added	% CaO^* Added	pH	Coliforms, MPN/gm**	Log MPN
0	0	5.4	2.9×10^9	9.46
0.9	5.5	8.2	6.1×10^8	3.78
1.8	5.5	7.3	2.5×10^4	4.40
2.7	5.5	7.0	8.9×10^2	2.95
4.1	5.5	5.6	9.7×10^6	6.99

*Added as hydrated lime.

**Dry weight of sludge.

Higher dosages of ferric chloride result in depression of the pH, and thereby produce lower coliform reductions. Overdosage with ferric chloride has been shown to produce increased efficiency in dewatering, as measured by filter yield.⁶ Since overdosage of this chemical also results in decreased efficiency from the standpoint of bactericidal action, it becomes increasingly important,

in filter operation, that chemical usage be carefully controlled and overdosage be avoided.

It appears from the results obtained thus far that chemical conditioning of sludge involves three environmental factors which result in coli kills: pH, lime concentration and ferric chloride concentration. There is an interplay among all three of these factors. In addition to the establishment of a highly alkaline environment which is a deterrent to the survival of pathogenic organisms, the conditioning chemicals have a coagulating effect on the various components of the sludge, including coliforms and other organisms.

The toxicity of ferric chloride toward coliforms and other sewage organisms has previously been shown. The use of lime in establishing an alkaline environment and thereby achieving bactericidal effects is virtually a tradition. If it is accepted that both of these reagents combine chemically with constituents in the sludge to form stable end products then the calcium and iron need not be expected to leach out. Furthermore, it is known that coliform organisms in freshly collected sewage sludge die off at a rapid rate upon standing.

Coliform counts determined on dewatered fresh sludge which has been stored on the ground for periods up to 6 months and more indicate that densities of these organisms do not increase. In fact, as might be expected, a reduction in numbers occurs as a result of exposure to weathering. Preliminary data indicate that, while filter cake from a dewatered fresh sludge does not show an increase in coliforms when stored on the ground, filter cake from a dewatered di-

gested sludge does show increases.

Further studies have been instituted to investigate the significance of other factors, such as moisture content, temperature, sludge source and disposal methods on the fate of coliforms in dewatered sludge. Efforts are being made to establish whether there is a correlation between chemical dosages required for optimum dewatering rate and the colicidal requirements with any given sludge. Also, the colicidal effect of other conditioning chemicals is being investigated.

A recent survey was made of 21 fresh sludge dewatering installations in the Midwest.¹ It was found that three of these installations incinerate the sludge; three stock pile the filter cake at the plant; three dispose of the cake by land fill; and the remaining twelve plants remove the filter cake to farms for agricultural use.

References

1. Dietz, J. C. "Sludge Filtration," paper presented at 13th Annual Purdue Industrial Waste Conference (1958) (to be published).

2. Dunlop, S. G., *PUBLIC WORKS*, 88, 80 (1957).
3. Heukelekian, H., *Sewage Works Journal*, 428 (1931).
4. Salle, A. J., *Fundamental Principles of Bacteriology*, McGraw-Hill Book Publishing Co., New York, N. Y. (1940).
5. Trubnick, E. H. *PUBLIC WORKS*, 87, 116 (1956).
6. Trubnick, E. H. and Mueller, P. K., "Biological Treatment of Sewage and Industrial Wastes," Vol. 2, 307, Reinhold Publishing Co., New York (1958).

SEWAGE SLUDGE THICKENING BY FLOTATION

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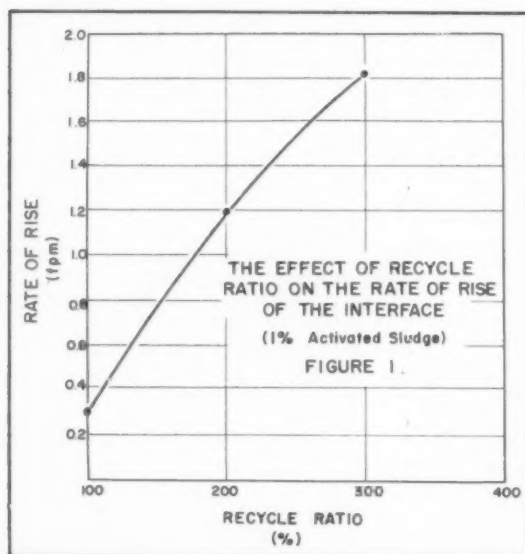
DISSOLVED-AIR flotation is a well known method for the removal of solids from water, particularly in the industrial waste treatment field. Several years ago laboratory studies were made on the use of flotation to remove from water such biological solids as activated

sludge, trickling filter sludge, and digester solids. Although these tests were directed to the study of clarification, an interesting side observation was that unusually dense top sludges were obtained. As a result, about a year and a half ago, a co-operative project was initiated with the Metropolitan Sanitary District of Greater Chicago to study, on a laboratory scale (later on a pilot plant scale), the possible use of flotation to thicken waste sludges. The

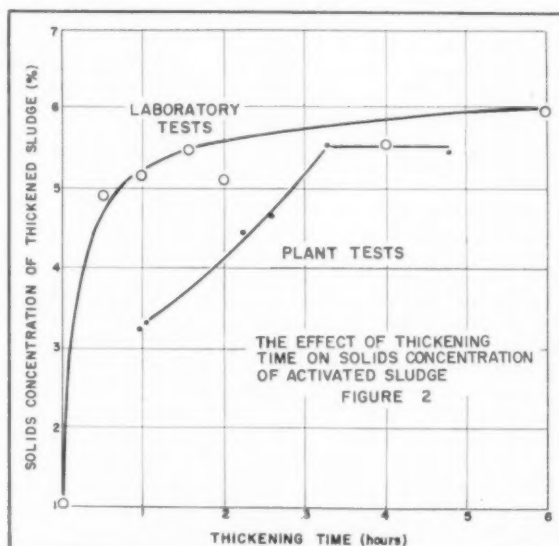
flotation method used in the tests employed a pressurized recycle stream as a means of introducing the fine air bubbles into the sludge.

The laboratory work was directed toward establishing the initial rates of separation of the solids from the water and the subsequent thickening rates, as well as solids concentrations obtainable with various sludge mixtures.

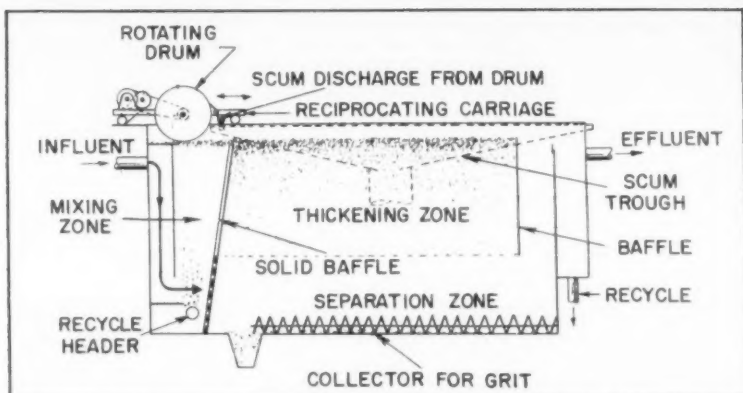
During the solids separation phase of the study, significant data were



● PRESSURIZED recycling introduces fine air bubbles for flotation. An increase accelerates the rate of rise.



● ABOUT 3 hours' detention time was required to obtain 5.5 percent solids in the pilot plant; 1.5 hours in laboratory trials.



● PILOT plant schematic arrangement for sewage sludge thickening by flotation.

obtained on the effect of recycle ratio on the rate of rise of the sludge particles. The three points in Fig. 1 represent average values of the rate of rise observed over a large number of runs. It will be noted that the rate of rise increased markedly as the recycle ratio was increased from 100 percent to 300 percent. (Percentage is based on sludge volume.) It is believed that the increased recycle ratio not only provided more air bubbles, but also reduced, through dilution, the effect of particle interference on the rate of separation.

The thickening rate or compaction rate was also studied. The upper curve in Fig. 2 is a typical one showing the effect of time on concentration of activated sludge. The data represented by this curve were obtained using activated sludge which was thickened by dissolved-air flotation. It may be noted that the activated sludge thickens rapidly within the first half hour to 4.5 to 5.0 percent solids. After one-half hour, the concentration of the activated sludge increased less rapidly. A 6-percent solids concentration was observed after six hours of thickening. Laboratory work over a period of six months showed that the results indicated in Fig. 2 were consistently reproducible.

The combined results obtained from the laboratory studies indicated that dissolved-air flotation offered a method of thickening sludges to higher concentrations in a shorter period of time than can be anticipated for gravity thickening methods. Encouraged by these laboratory studies and results, a pilot plant was designed and constructed.

The solids separation zone of the pilot plant flotation unit provided a separation rate of 1.2 fpm, assuming a 200-percent recycle rate. The upper portion (or thickening zone) of

the flotation basin was designed to provide sufficient residence time to assure a sludge blanket of greater than 5 percent solids when handling 1 percent activated sludge feed.

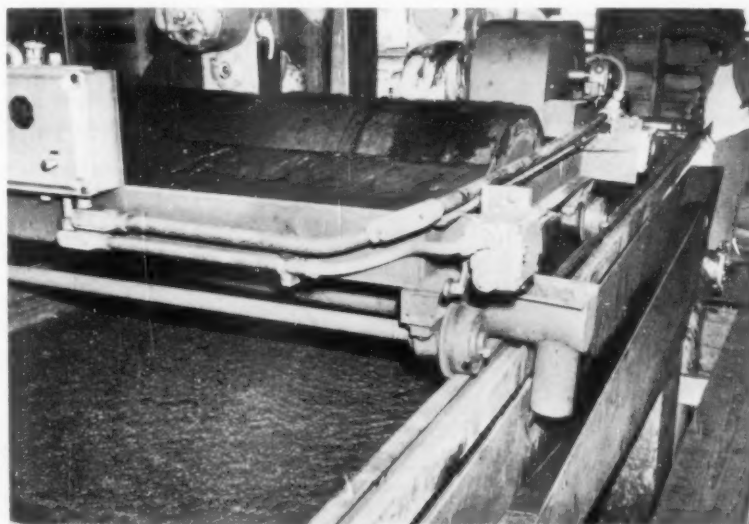
A recycle ratio of 200 percent was established as satisfactory early in the pilot tests. The problem of removing the thickened sludge from the tank without interfering with the thickening process soon presented itself. The flotation basin originally was constructed with a conventional overhead flight conveyor. It was observed that as the flights moved the top layer of sludge in the sludge blanket, undesirable turbulence was caused. This turbulence disrupted the concentration gradient in the blanket, thereby reducing the percentage of solids in the thickened sludge. This indicated a need for a new method to remove the sludge without the necessity of conveying the solids in the top of the sludge

blanket. A revolving roll mounted on a reciprocating carriage contacts the sludge blanket. As a result of cohesive forces within the sludge, the roll picks up the sludge from the blanket at the point of contact. A scraper or doctor blade removes the sludge from the roll and discharges it into a trough.

After the proper recycle ratio, optimum sludge blanket depth and a satisfactory sludge removal means were established, studies were conducted to observe the effect of solids-holding-time on the thickened sludge concentration, Fig. 2.

Slightly greater than three hours detention time were needed to obtain a solids concentration of approximately 5.5 percent, compared to 1.5 hours required in the laboratory work. It is believed that the difference in the detention times may be explained by the fact that the laboratory tests used a batch process, whereas the pilot unit was a continuous flow process. Hydraulic factors, such as shortcircuiting, may increase the required detention time.

Tests were conducted on various mixtures of activated sludge, high rate activated sludge, and primary sludge. The results indicated that in two hours a concentration of 7.7 percent solids may be anticipated with a half-and-half mixture of activated and primary sludge. Primary solids may be thickened to 10.7 percent in two hours by dissolved-air flotation. The advantages of dissolved-air flotation over conventional gravity thickening are: 1) Shorter detention times, 2) possible higher solids concentrations, and 3) greater control of process.



● ROLLER mounted on a reciprocating carriage picks up sludge from the blanket at the point of contact. A scraper removes the sludge from the roller to a trough.

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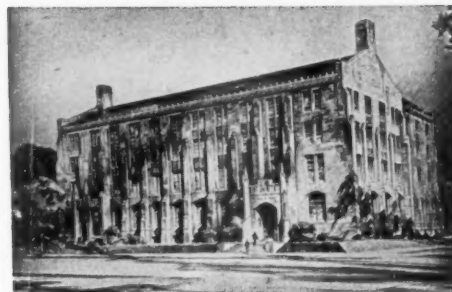
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News BULLETINS



AMERICAN PUBLIC WORKS ASSOCIATION, 1313 EAST 60th STREET, CHICAGO 37, ILLINOIS

APWA Membership Continues to Increase at Rapid Rate

Chicago, Ill.—Featured in the 1958 Annual Report of Executive Director Robert D. Bugher is the continuing high rate of growth of the membership. Data for the twelve month period (1 September 1957 to 31 August 1958) reported at the Public Works Congress in Kansas City showed a net increase of 423—the largest net gain of any similar period in the history of the Association. The APWA now has well over 4000 members—more than twice as many as in 1952.

During the same 12 month period 45 more cities were added as public agency members making a total of 215 cities throughout the United States and Canada which have taken advantage of the benefits available through this type of membership.

The Executive Director also reported that the establishment of 16 new Chapters during the past six years now makes it possible for 86 percent of the membership to be affiliated with local chapters. APWA has a total of 30 chapters serving the membership.

Chicago Chapter Presents \$1,000 to

APWA Research Foundation

Chicago, Ill.—The Executive Committee of the Chicago Chapter recently took the necessary action to authorize contribution of \$1,000 from the Chapter's funds to the American Public Works Association Research Foundation.

The Committee, in announcing the grant, stated that the contribution

was made possible, to a large degree, through the continued and generous assistance of the Chapter's activities by its many supporters.

The APWA Research Foundation was established in 1955 to promote research in the field of public works



Milton Offner (left), Chairman of the Board of Trustees of the APWA Research Foundation accepts check for \$1,000 from Bill Smaha, Chicago Metropolitan Chapter President.

engineering and administration. It is a function of the American Public Works Association, but its operations are governed by a separate Board of Trustees.

The purpose of the Foundation is to serve State and local units of government by continuously evaluating the status of public works activities; by identifying its major problems, and by determining the most promising approaches to their solution. It also provides a practical

means by which such units of government, with the aid of public-spirited individuals and organizations, may voluntarily contribute to the support of research.

Hedges Named President of New Missouri Chapter

Kansas City, Mo.—The newly organized Missouri Chapter of APWA held its inaugural dinner meeting in Kansas City's Muehlebach Hotel on September 30, with some 26 public works officials present. Robert D. Bugher, Executive Director of APWA, congratulated those present on the formation of the Chapter and introduced the speaker of the evening, Robert L. Anderson, Superintendent of Public Works and Village Engineer, Winnetka, Illinois, and Immediate Past President of APWA.

Mr. Anderson also extended his congratulations and discussed the aims and activities of chapters throughout the country.

Elected to guide the Chapter's activities for the coming year were: W. E. Hedges, Director of Public Works and City Engineer of Springfield, President; Clarendon Rea, Commissioner, Refuse Collection Division, Kansas City, Vice-President; W. Raymert Miller, Director of Public Works, Columbia, Secretary-Treasurer; Earl W. Deering, Commissioner, Div. of Refuse Collection & Disposal, St. Louis, and James R. Huff, City Engineer, Mexico, two year terms on the executive committee; and Victor N. Napolilli, Asst. Director of Public Works, University City, and R. E. Crews, Director of Public Works, Joplin, to one year terms on the executive committee.

OFFICERS: Wm. D. Hurst, Winnipeg, Manitoba, Canada, *President*; Jean L. Vincenz, San Diego, Calif., *Vice President*. REGIONAL DIRECTORS: (term ending 1959) Albert G. Wyler, New Orleans, La.; Edwin J. Booth, Bismarck, N. D.; Frederick Crane, Buffalo, N. Y.; (term ending 1960) Charles W. Cooke, Hartford, Conn.; R. S. Hopson, Richmond, Va.; H. H. Hester, Fort Worth, Tex.; (term ending 1961) Louis H. Moehr, Wyandotte, Mich.; John A. Morin, Oakland, Calif.; W. A. Bowes, Portland, Ore. *Immediate Past President*, Sol Ellenson, Newport News, Va. Robert D. Bugher, *Executive Director*

Zentgraf Elected President of NY-NJ Metropolitan Chapter

Brooklyn, N. Y.—At the Fall Meeting of the New York-New Jersey Metropolitan chapter an interesting and informative program was provided by the Department of Sanitation of the City of New York. Commissioner Paul R. Screvane was chairman of the meeting, held at the New York State Armory in Brooklyn on October 29. Approximately 400 members and guests were present, and 34 exhibitors displayed their equipment and materials.

Following a formal welcome by Commissioner Screvane, an excellent paper entitled "Training of D. S. Personnel" was given by William Kueper, Director of Training, New York City Department of Sanitation. Two films were shown, one on expressways, the other on sanitation.

After the technical session the group was taken by chartered bus to the D. S. Training Center where they were given a 30-minute tour of the center. The next stop on the tour was the Greenpoint Marine Transfer Station, where this installation was explained. The final stop

was for an inspection of the Greenpoint Incinerator.

A cocktail hour was held in the Officers Cocktail Lounge of the New York Navy Yard, prior to the dinner that was held in the Officers Dining Room. Stanley Lowell, Deputy Mayor, welcomed the members to the City of New York.

A short business meeting following dinner with Chapter President Casimir A. Rogus presiding included election of a new slate of officers. August Zentgraf, Chief Engineer, Division of Sanitation, Newark Department of Public Works, was named President. Other newly elected officers are Floyd Wilcox, Supt. of Public Works, Lynbrook, N. Y., Vice President; John Baffa, Consulting Engineer, New York City, Treasurer; and Elroy Spitzer, Engineering Editor, "The American City," Secretary; with Arthur Brokaw, City Engineer, East Orange, N. J. and Francis Griffin, Village Engineer, Larchmont, N. Y., as Board Members.

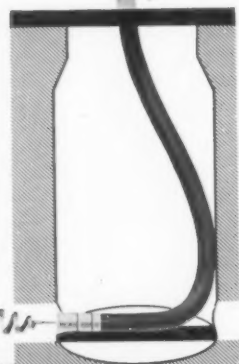
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Mellenthin Elected President of Utah Chapter

Salt Lake City, Utah—The Utah Chapter of APWA held its annual meeting on September 12 in the Terrace Room of the Newhouse Hotel in Salt Lake City. Following a business meeting which was called to order by President Carl E. Painter, members had a choice of two technical sessions, one on planning and zoning and the other on municipal water works and sanitation.

The all-day session also included an election of officers for the coming year, putting into office as President, B. E. Mellenthin, Assistant City Engineer of Salt Lake City; 1st Vice-President, George B. Gudgell, Consulting Engineer, Salt Lake City; 2nd Vice-President, Harold J. Tip-pets, Surveyor, Davis County, Farmington; Secretary - Treasurer (re-elected) Mrs. Lyla Ray, Utah Municipal League; Board Members, Rex O. Gleave, Engineer, Phillips Petroleum Co., Salt Lake City; Allan C. Carter, Engineer, Portland Cement Association, Salt Lake City, and Melvin C. Denhalter, Street Department Coordinator, Salt Lake City. C. E. Painter remains on the Board as Past President.

Western Pennsylvania Chapter Visits Sewage Treatment Plant

Pittsburgh, Pa.—Thirty-six members and guests were present for the first regular meeting on September 11 of one of APWA's newest



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The City of Red Bank-White Oak, Tenn. (Pop. 10,200) bought this "PAYLOADER" to handle their sanitary refuse disposal. This rubber-tire tractor-shovel has been so efficient at the dump—spreading, compacting and covering the refuse—that it requires only two hours each day to do the job.

In its "spare" time, it rolls all around the town to wherever it is needed. So far its "extra" work has been both valuable and varied—loading street patching materials, grading playgrounds, laying pipe in the storm drainage system, plowing streets for street repairs, transporting timbers, removing stumps.

According to City Manager, Cliff Greenwood, they are so impressed with the versatility and mobility of the "PAYLOADER" that they are on the lookout for even more ways to use it.

Black-topping Attachment

Mr. Greenwood says they plan to buy a Ram black-top Spreader attachment for their "PAYLOADER" so

they can also use it to patch streets. This attachment, available exclusively for "PAYLOADER" tractor-shovels, mounts easily in place of the bucket and will lay either hot or cold mix material. It is adjustable for patching any widths up to 48 inches and can lay a full six-foot strip whenever required.

Other Valuable Attachments

In addition to the black-top Spreader, many other attachments can be obtained for "PAYLOADER" units, and are of special interest to Public Works departments. Hydraulic back-hoes, pick-up street sweepers, blower, V- and blade-type snow plows, back-rip scarifier teeth, crane hooks, fork lifts and side booms are available—and some of these are exclusive "PAYLOADER" attachments.

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local affiliates, the Western Pennsylvania Chapter.

Various phases of street maintenance were topics for discussion at the morning session by a panel moderated by Ralph S. Liebeau of Whitehall Borough. Robert B. Perry, City Engineer of Meadville, presented a paper on street cleaning and leaf collection; Joseph A. James, Institute of Local Government, Pittsburgh, described the "model" street opening ordinance prepared by the Institute and William C. Peternel, Director of Public Works

of Mount Lebanon, discussed the importance of joint sealing. A motion picture on the "how" of joint sealing followed.

During the afternoon, the members were conducted on an extensive tour of the sewage disposal facilities of the Allegheny County Sanitary Authority, one of the largest in the country. Arrangements for the field trip were made by John L. Laboon, the Authority's Chief Engineer and Henry S. Carr, Resident Engineer. The next meeting is planned for February.

NEW LINE OF TRENCHERS AND BACKFILLERS SHOWN BY CLEVELAND TRENCHER COMPANY

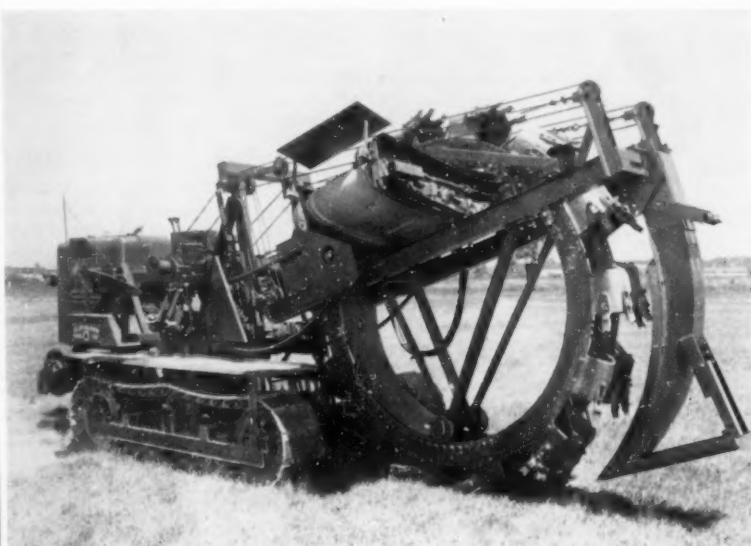
ON SEPTEMBER 18, 19, and 20, at Cleveland, Ohio, the Cleveland Trencher Company demonstrated before their distributors and the press their complete new line of trenchers and backfillers. There were 6 trenchers, a side-crane backfiller and a backfiller previewed before a large audience. Typical digging and back-filling jobs were performed with outstanding ease and operation.

The J-20, J-30 and J-40 Cleveland trenchers have the new V-conveyor construction which gives increased discharge clearance under the digging wheel and constant maximum elevating angle for faster spoil elevation and discharge. It also gives stronger frame construction and eliminates misalignment. Cleveland's new dual conveyor drive features hydraulic motor and planetary gear

self-contained within each head pulley which eliminates all sprockets, chains and open gearing. The V-conveyor is automatically shifted and positioned hydraulically from the operator's seat. The operator does not have to leave his seat to operate the trencher.

The JS-30 trencher has the above mentioned features plus an instant lateral digging wheel shift (30 inches each side of center) hydraulic crumbling shoe hoist and digging wheel power-tilt.

The Model 190 backfiller has a new water cooled throw-out clutch and new raised boom hinges. The new clutch keeps in adjustment, cannot overheat and the linings last longer. Operator control of the backfill board permits easier casting and provides same performance ease at day's end as at start.



● MODEL J-30 trencher described above digs 5½ feet deep; 11 to 25 inches wide.

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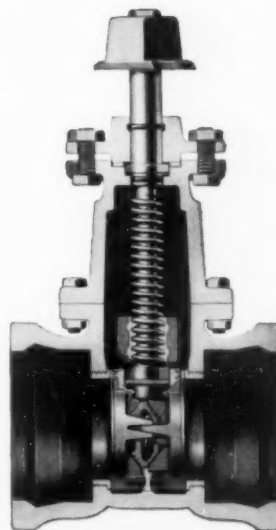
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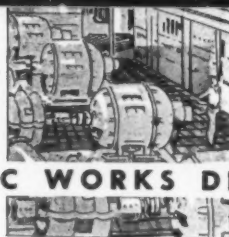
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PUBLIC WORKS DIGESTS

Prepared by

ALVIN R. JACOBSON, Ph.D.

Associate Professor and Head,
Division of Sanitary Science,
Columbia University School of Public Health

THE WATER WORKS DIGEST

Prestressed-Concrete Tower

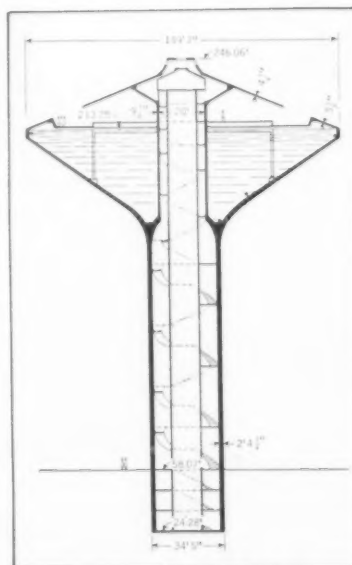
The recently built water tower in the City of Orebro, Sweden, has a central location which necessitated an effective architectural design. Because of its large volume of 2.4 million gallons, and its height of 160 ft. between the ground and the high water level, a conventionally designed cylindrical reservoir supported by columns or cylindrical walls was considered too bulky. With the aid of prestressed concrete it was possible to create a more slender and elegant structure. The maximum diameter is about 150 ft. The outer surface is polygonal with 32 faces. Special attention was given to handling stresses throughout the design. The supporting cylindrical stem has an outer diameter of 34 feet 5 inches. Because of a deep fault in the rock, the foundation had to be blasted down some 33 ft. below ground level. In the basement levels so obtained, there will be a furnace room, a storage area, a valve chamber, and other facilities. The cylindrical stem also encloses a staircase and a concrete cylinder, which contains two elevators, each with a capacity of ten persons. For radio and television purposes, two rooms have been provided in the cylindrical stem, and a mast has been raised on top of the structure. The central part of the roof structure is designed as a restaurant. Outside the restaurant there is a lookout balcony. This article presents an excellent description of the construction procedure and is accompanied by a number of photos and diagrams giving details.

"Prestressed - Concrete Water Tower in Orebro, Sweden." By Kurt Eriksson. *Civil Engineering*, October, 1958.

End Ice Problems

The Council Bluffs, Iowa, City Water Department has ended its constant battle waged against ice formation each winter at the river intake, as well as on and in the treatment and settling basins. This was accomplished as the result of

a deep well project completed late in 1957. In the new treatment plant which was completed in 1952, an air bubbler system was installed in all settling basins to prevent the formation of heavy surface ice layers. However, the bubbler system created a new problem—the formation of a type of anchor or frazil ice that at times caused considerable difficulty through the plugging of clarifier effluent ports. In addition, this ice also formed and precipitated on the bottom of the clarifiers in large amounts thereby overloading and stopping the sludge collection rakes. The ice problem has been solved by sinking a new well approximately 250 feet from the Missouri River and about 50 feet from one of the preliminary settling basins. It is 121 feet deep and furnishes water at a temperature of 54°F. which is blended with the 33°F river water. The blended water temperature remains practically constant at 36°F. providing a safe margin against freezing. The deep well project was only one part of a \$700,000 expansion program which was carried out in 1957.



Courtesy Civil Engineering

● WATER tower of prestressed concrete has 2.4 mg capacity, is 150' diam.

"Blended Well-River Waters End Ice Problem in Plant." By M. E. Rew. *Water Works Engineering*, October, 1958.

Orlando, Fla., Changes Supply

The City of Orlando, Fla., in developing its water supply, reversed its long-time policy and switched from a surface water supply to wells. In making this change the City's Utility Commission did these things: 1) Placed the largest single water well contract on record, involving 11 wells with about 3½ miles of casing. 2) Provided complete automation in its chlorine-sterilizing portion of the work; adjustments in chlorine requirements are automatic and continuous, both on the basis of flow and chlorine demand. 3) Provided a system of automatic control so that one man at a central station can provide complete control of the operation of four outlying pumping stations in widely scattered locations, thus saving the cost of 12 separate operators. The entire system has been designed to serve a population of 150,000 at a per capita rate of 150 gallons per day. The water rates have been increased somewhat to pay for this construction program. Currently, the charges are \$1.50 for 4,000 gallons per month inside the city limits and \$2.40 outside the city limits. A carefully developed watermain extension policy has been in effect for some time and seems to serve the city very well in financing new construction.

"Orlando, Fla., Scores Triple Firsts." *The American City*, October, 1958.

Chlorine Effect on Enteric Viruses

The authors report on some studies of the effects of chlorine residuals on several enteric viruses, namely polioviruses and other kinds of Coxsackie viruses. The effects of combined and free available chlorine residuals were determined on the following enteric viruses: Poliovirus types 1 (Mahoney), 2 (MEF₁), and 3 (Saukett); Coxsackie B



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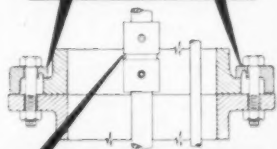
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1 (49683) and B 5 (EA 80). These strains had been cultivated in monkey kidney or HeLa cell cultures. Two strains of poliovirus type 1, MK 500 and 487, recently isolated from sewage, were also included. The data indicate that enteric viruses differ in their sensitivity to chlorine residuals as do enteric bacteria. Complete inactivation of enteric viruses (beyond the limit of detection) was not achieved by the usual conditions for bacterial disinfection of water supplies, i.e., free residual chlorine concentrations of 0.2 ppm for 10-minute contact at pH 7. The results suggest that inactivation of enteric viruses in water at pH 7, 25°C., requires a minimum free available chlorine residual of 0.3 ppm for contact periods of at least 30 minutes; at higher pH levels or lower temperatures, more intensive chlorination is necessary. The results also indicate that contact periods of at least four hours were necessary for inactivation by combined residual chlorine concentrations of 0.7 ppm. Strains of virus in decreasing order of their sensitivity to chlorine were as follows: Cocksackie B 5, poliovirus 1 (Mahoney), poliovirus 2, Cocksackie B 1, poliovirus 3 and poliovirus 1 (MK 500). A number of tables and graphs ac-

company this excellent presentation on this important subject.

"The Effect of Chlorine in Water on Enteric Viruses." By Sally Kelly and Wallace W. Sanderson. *Jour. APHA.*, October, 1958.

Chlorination of Water

This article is the first of a series of six articles on chlorination practices devoted to the chlorination of water. The purpose of this series is to review briefly the fundamental principles of chlorination processes as they relate to conventional water and waste treatment practices; to point out some of the principal hazards and flagrant abuses that are associated with chlorine use, and various means by which these can be minimized or corrected; and to delineate in a practical way, safe and effective handling techniques using equipment evolved from the cautious but rapid advancement of the science and art of chlorination. This first article discusses chlorination theory, chemical and biological effects of chlorine, chlorine disinfection, free and combined available chlorine residuals, and points of application, both pre- and post-chlorination. Several figures illustrate typical biological and chemical ef-

fects of chlorine in the treatment of water and wastes.

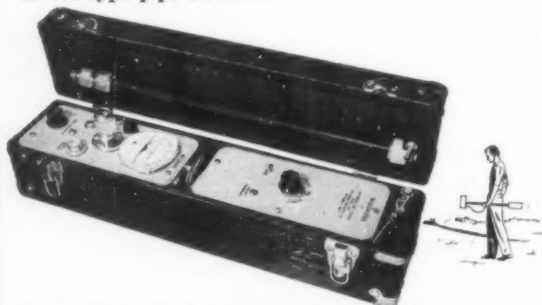
"Chlorination of Water." By Edmund J. Laubusch. *Water and Sewage Works*, October, 1958.

Leak Detection

There are numerous types of leak detectors on the market but, basically, only three ways of detecting leaks are involved: By sight, by sound, or by "supernatural" means. Only the first two are discussed in this article as they are the only ones based on scientific proof. The sight of water coming onto the surface of the ground or causing the melting of the snow during the winter are two examples of the first method. Amplification of the vibration produced by the escaping water is the basis of the second type of leak-detecting devices. The simplest type is the mechanical amplifier, which resembles a doctor's stethoscope, and sells for \$3 to \$8. The battery-operated leak detectors, which amplify the sound electrically, generally increase in price, depending upon the increase in power and efficiency. The three principal steps used in locating a leak are 1) making a preliminary survey by placing

THE NEW MINIATURIZED WILKINSON LINE LOCATOR MODEL W-3

This radically new, powerful, transistorized locating instrument weighs only 4 pounds and is 1/4 as large as old type pipe locators.

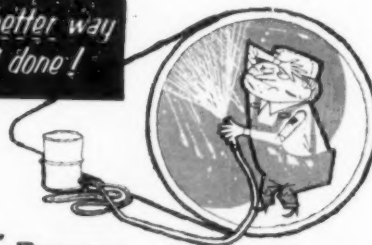


It's as handy as a flash light. The transistors rarely, if ever, require replacement; non-leak mercury cells outlast old type batteries at least ten times. The instrument cases are molded glass fibre. The aluminum connecting handle telescopes to 17 inches, and the entire instrument comes in a substantial carrying case.

Write today for illustrated brochure and instruction manual.

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there's a better way
to get it done!



by
"Spunline" Process



Cement mortar lining is applied uniformly by centrifugal "Spunline" Process.



Centrifugally rotating head of Spunline applicator provides uninterrupted continuity.

Newly developed Spunline Process... a combination of the world famous Tate and centrifugal processes... is now available for cement mortar lining of 6" to 16" diameter pipes "in place." Permits application of thinner lining with closer tolerance... permits lining past smaller openings and corporation stops... through many bends and certain fittings. Particularly advantageous with cast iron pipe... restores flow coefficients, protects against corrosion, contamination. Write today for full information.

Specializing in Pipe Protection Problems
• Tate, Centrifuge, Spunline "In Place" Interior Cement Mortar Lining
• "In Plant" and "Railhead" Centrifugal Spinning of Cement Mortar or Coal Tar Linings, Somatics, Exterior Coatings
• Pipe Wrapping • Reclamation • Removal of Old Wrapping, Straightening, Blasting, Beveling, Testing

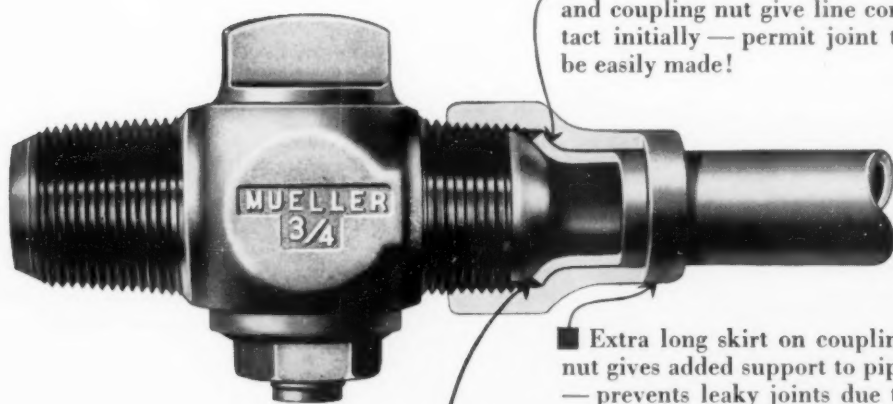
PIPE LININGS

A Division of
American Pipe
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2414 East 223 St. (P. O. Box 457)
Wilmington, California

MUELLER[®] CORPORATION STOPS

... with **MUELLER**
copper service pipe connection



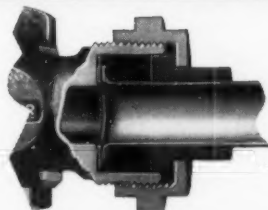
■ Convex surfaces on stop body and coupling nut give line contact initially — permit joint to be easily made!

■ Extra long skirt on coupling nut gives added support to pipe — prevents leaky joints due to pipe movement!

■ Opposed convex surfaces do not compress end of flange — give greater resistance to pipe pulling out.

Sizes from 1/2" through 2"

NEW
INSULATING
COUPLING
OUTLET



H-15007 Sizes 3/4" and 1"

Mueller corporation stops with insulating coupling outlet completely insulate copper service pipe from main to minimize electrolytic corrosion.



MUELLER CO.
DECATUR, ILL.

Factories at: Decatur, Chattanooga, Los Angeles;
In Canada: Mueller, Limited, Sarnia, Ontario

Municipal Water Filter Installation cost can be cut 1/3 to 2/3 with...

★ This Filter is also used extensively for swimming pool and industrial plant water filtration.

SPARKLER
Diatomite
FILTERS

Engineers in charge of new Municipal Water Works filtration systems are more and more favoring the SPARKLER DIATOMITE FILTER MODEL RJ because:—

1. The original cost of a diatomite plant for public supply is $\frac{1}{3}$ to $\frac{2}{3}$ the cost of a sand plant of equal capacity.
2. Diatomite filtration reduces bacteria and removes organic matter to an exceptionally high degree with attendant low chlorination requirement. This results in reducing consumer complaint due to chlorinous tastes.
3. Turbidity less than 5 P.P.M. can easily be maintained at all times even though the raw supply fluctuates greatly. Channeling, mud balling and other common sand filter shortcomings are never a problem.
4. Operating cost compares favorably with conventional sand.
5. Sparkler Filters can be used with pretreated water when such treatment is necessary or desirable.

Sparkler filtration engineers have introduced, in the RJ filter, new principles of diatomite filtering that are much superior to old methods and comprise the most advanced developments in recent years.

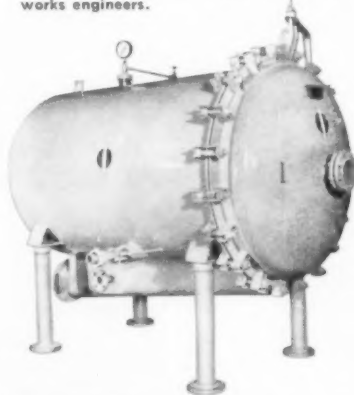
Less than 0.2% of the harvested filtered water is required to sluice and clean the Model RJ filter. The largest filter units can be cleaned and a new fresh diatomite pre-coat applied and the filter back in operation in 20 minutes or less.

Operators can be easily trained to handle this filter, highly skilled specialized personnel is not required to insure efficient performance.

Sparkler Model RJ filters can supply practically any required volume of city water. Single units with a capacity of 2,000,000 gal. per day are available. Multiple units including a standby filter is usually employed to insure uninterrupted service for large volume requirements.

Modern electronic control instruments are readily adaptable to these filters, making uniform high quality water supply sure and automatic.

The startlingly low original cost, simple operation, and positive, consistent high quality filtration makes the Sparkler Municipal Water Works filtration system worthy of the most thorough consideration by water works engineers.



SPARKLER MFG. CO., MUNDELEIN, ILL.

Sparkler International Ltd. with plants in Canada, Holland, Italy and Australia — Service representatives in principal cities throughout the world.

**SPARKLER
FILTERS**

FILTRATION ENGINEERING AND MANUFACTURING EXCLUSIVELY FOR OVER 35 YEARS.

the instrument on each of the fire hydrants or main line valves in the water system, the hydrants being one of the principal sources of leaks; 2) checking all services in the area with the highest instrument readings; and 3) location of the pipe causing the leak. Leaking valves are located in the same general manner. Both of the two basic types of electrical pipe locators—the conductive and the inductive—have their advantages and water departments would probably benefit by having both types as indicated in this article. There are several electronic mine detectors or valve box detectors available on the market which take much of the guesswork out of the location of valve boxes. The use of any of these devices, however, requires patience and common sense.

"Detection and Location of Underground Leaks, Pipelines, and Valves." By Norvel E. Ireland. *Jour. AWWA.*, October, 1958.

Sampling Inspection Methods

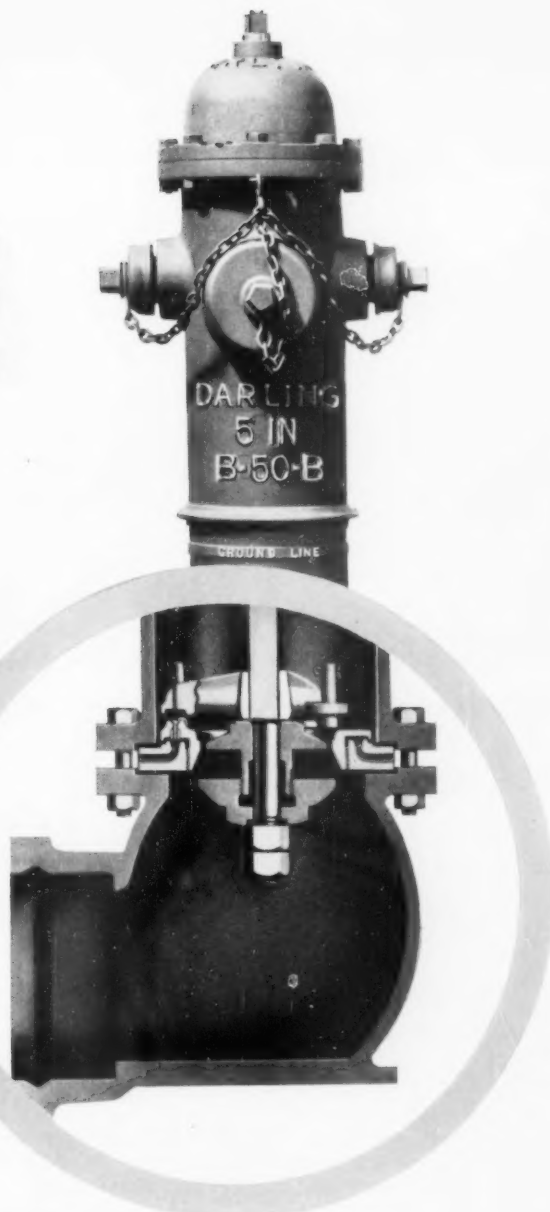
The author discusses the application of sampling inspection methods, as currently used in industry, to the receipt of $\frac{3}{8}$ -inch water meter shipments at the Dallas City Water Works. These methods were designed to achieve a maximum of control over the percent defective accepted, while at the same time holding inspection costs to a minimum. Two features of these methods which tend to minimize the amount of inspection required are: 1) A sequential (in this case double) sampling plan is followed; and 2) average quality of a run of shipments is primarily brought under control, rather than the quality of any particular shipment. The Dallas City Water Works samples 10 percent of its meters, setting their control at the 1.0 percent defective allowed level, this control set up on the assumption that from 0.03-0.20 percent of the meters received are defective. If the determined number of defectives is below the number permitted the shipment is accepted, but if the number of defectives exceeds the number permitted then the entire shipment is inspected and none of the defectives is accepted. Industrial firms have used inspection procedures of this and similar types for many years at substantial savings.

"Sampling Inspection Methods in Quantity Purchases of Water Meters." By Dan A. Brock. *PUBLIC WORKS*, November, 1958.

(For "Other Articles" see page 130)

In Darling Hydrants

TROUBLE CAN'T COLLECT HERE....



EVER SINCE modern fire hydrants were invented, designers have aimed, with more or less success, at positive, complete water drainage to prevent freeze-ups, corrosion and binding. And this is another successful feature of major importance in the design of Darling hydrants. Consider...

1 An unmatched safety factor is assured by automatically operated, compression type drain valves and unique triple-ported in the main valve seat!

2 For an interval during each opening or closing of the main valve, the drain ports are automatically force-flushed by line pressure to remove any sediment. And, when the main valve is closed, these ports remain fully open to assure the release of all remaining water.

3 The water drains from the barrel through 3 ports into the

bronze drain ring which has 10 to 18 ports to allow water to escape into the ground and eliminate all possibility of clogged drains.

This and other equally important Darling design features are your assurance of the smoothest, surest, safest hydrant operation known today. For all details, including the range of types and sizes, ask for Bulletin 5710.



DARLING VALVE & MANUFACTURING CO.

Williamsport 22, Pa.

Manufactured in Canada by The Canada Valve & Hydrant Co., Ltd., Brantford 7, Ont.



Gasoline, Diesel, or LP Gas—New Multi-Range 6-cylinder engines for the International 460 Utility—gasoline, Diesel, LP Gas—deliver 61 hp at the fly-wheel, 48 at the drawbar.

New International® 460 Utility tractor

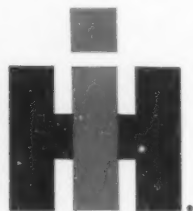
...SMOOTH 6-CYLINDER POWER

with brawn to match!

Add new Multi-Range 6-cylinder power to International's traditional built-in brawn... you literally step into a *new world of utility tractor performance!*

Here's sensationally SMOOTH power, virtually vibration-free, to lessen operator fatigue and thus step up daily output. It's *economical* power, because new Multi-Range design delivers remarkable fuel economy at every load range. It's *flexible* power, with instant governor response to load demand at any engine speed from 900 to 1,800 rpm. And it's power, *balanced* with built-in brawn, that delivers over 48 drawbar horsepower for the widest range of heavy-duty utility tractor work.

Ask your IH dealer to demonstrate the new 460 Utility... or others in the complete International line, 12.8 to 72.5 bare engine hp. For free catalog, or name of your nearest IH dealer, write International Harvester Company, Dept. PW-12, P. O. Box 7333, Chicago 80, Illinois.



See Your
**INTERNATIONAL
HARVESTER Dealer**

International Harvester Company products pay for themselves in use—Farm Tractors and Equipment...Twine...Commercial Wheel Tractors...Motor Trucks...Construction Equipment—General Office, Chicago 1, Illinois



Built-in brawn means tractor strength and stamina to handle big buckets on heavy-duty International Pippin or International Wagner backhoes—sizes for trenching to grade 10, 12½, or 13¼ feet deep.



New Fast Reverser Unit speeds up shuttle-type operations. In each of five gears, the reverse speed is 22 per cent faster than the forward speed in that gear.

... familiar **HIGH SIGN**

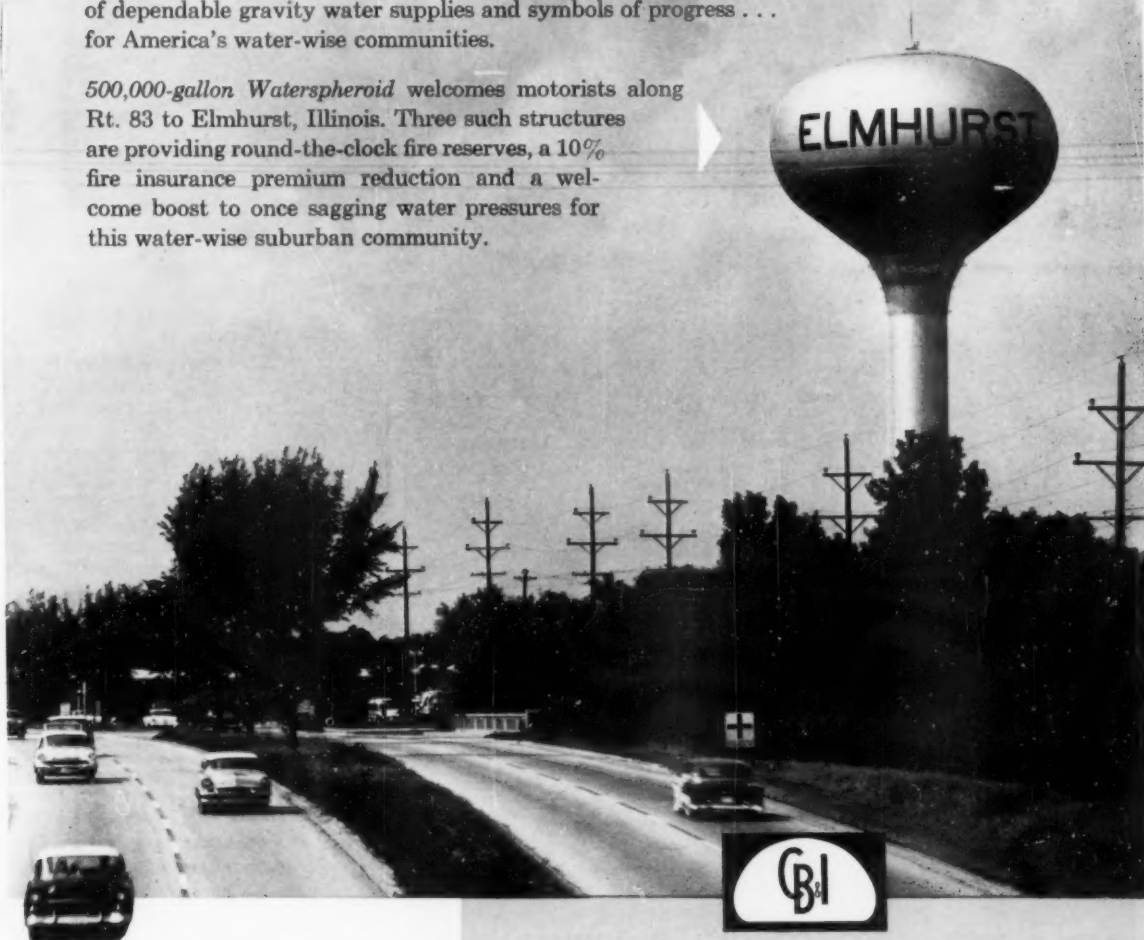
of the progressive community

Horton Waterspheres® and Waterspheroids® now grace the skyline over hundreds of progressive communities because they meet today's municipal standards for dependable performance and ease of maintenance . . . in a handsome, functional "package".

The all-welded structures require little ground space for foundations and bases can be used for pumping or storage. They are easy to paint and maintain . . . and their *modern designs* meet the aesthetic standards of *modern communities*.

Waterspheres and Waterspheroids have become landmarks of dependable gravity water supplies and symbols of progress . . . for America's water-wise communities.

500,000-gallon *Waterspheroid* welcomes motorists along Rt. 83 to Elmhurst, Illinois. Three such structures are providing round-the-clock fire reserves, a 10% fire insurance premium reduction and a welcome boost to once sagging water pressures for this water-wise suburban community.



Waterspheroids are built in capacities of 250,000 to 500,000 gallons. Waterspheres serve in range of 25,000 to 250,000 gallons. Write the nearest CB&I office for literature.

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Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY,
GREENVILLE, PA. and at NEW CASTLE, DELAWARE.

In Canada: HORTON STEEL WORKS LTD., TORONTO, ONTARIO

M53C

The Water Works Digest

Other Articles

"Texas Town Builds Giant Water Tank of Prestressed Concrete." This article presents details of construction of a 2,000,000 gallon tank and supporting concrete structure by the slip-form method. By Robert E. Fix. Water Works Engineering, October, 1958.

"Conversion of Saline Water Into Fresh Water. A non-technical summary presentation of current progress and costs for the five most important methods of desalting. By Sheppard T. Powell. Water Works Engineering, October, 1958.

"Water in Modern Fire Control." The

author discusses the mutual and closely related problems of the water supply engineering and fire protection professions. By Mathew M. Braidech. JAWWA., October, 1958.

"Determination of Synthetic Detergent Content of Raw-Water Supplies." A report of Task Group 2662P-Analytical Methods for Synthetic Detergents. By James C. Vaughan, Chairman. JAWWA., October, 1958.

"Florida Cities Turn to Surface Water." Two Florida east coast cities, Melbourne and Lake Worth are substituting surface water for well water, either in whole or in part, because of salt water intrusion. By C. E. Wright. Public Works, November, 1958.

Functional Office Facilities

(Continued from page 85)

his elbow a specially-designed, double-faced reference-storage table. The staggered arrangement of the drafting tables, the fact that alternate rows of draftsmen face in opposite directions and the special design of the reference tables permit maximum utilization of the space available. The room is approximately 60 ft. by 66 ft., with an average of 66 square feet per man including general and individual reference and storage space. Light, ventilation and sound-absorption are as nearly ideal as possible. The smaller basement drafting room is closely similar and meets the same high standards.

Interior painting is in soft, pleasing colors, chosen with professional advice. The services of an interior decorator were retained on a consulting basis from the beginning of the design to the completion of the building.

The partial second floor, 80 by 45 feet, over the front portion of the building, was wisely conceived to serve for possible or inevitable future expansion of the firms while providing presently-profitable rental space. The only part now used by the owner is one separate, private room housing a Bendix G-15D electronic computer. Extra cooling capacity is provided in this room to counteract the heat produced by the machine.

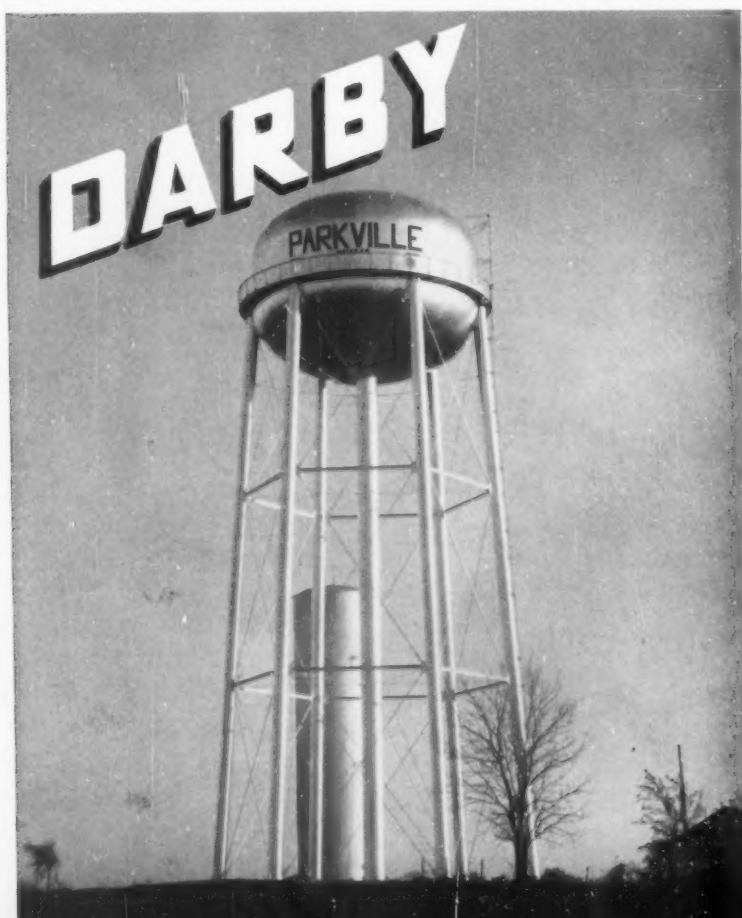
The outstanding functional feature of the grounds is the 57-car parking space for employees and visitors. Future expansion of parking space can be obtained, if needed, by utilizing a portion of the tract now occupied by two houses. In the rear, a 20 by 32-foot metal building on a concrete slab provides storage space for field equipment.

Fully utilized already (except for the second floor rental space), this fine building is a near-ideal home for efficient, convenient functioning of the firms. An overall improvement in working conditions has been realized, compared to those in former rented facilities. It is predicted that increased efficiency will in the long run bring a savings in dollars.

• • •

Highway Maps Printed


The Michigan State Highway Department printed 600,000 maps for free distribution upon request during 1957. The 1958 edition has had new symbols, type, color and a new base.



Overshadowing the now inadequate storage facility it replaces, this modern elevated structure places 300,000 gallons of water in reserve to meet demands of Parkville Water Co. customers.

Cost estimates available on request

THE DARBY CORPORATION
Kansas City Kansas





The Mathews barrel, containing all working parts of the hydrant, is readily removed for inspection or repair by simply unscrewing it from the elbow and withdrawing it through the protection case.

I want you to see for yourself how the Mathews replaceable barrel is a real community asset

I can show you easily and quickly with this scale model. See? When a Mathews is broken by a skidding automobile, you can slip in a new barrel in a matter of minutes, *and without excavating*. It's a real safety feature for the community—allows only momentary interruption of neighborhood fire protection.

And these additional quality features help keep the Mathews at the head of the line:

- Compression-type valve opens against water pressure—a positive leakproof construction
- Operating thread cannot be bent
- Head revolves 360° just by loosening bolts
- Nozzle sections are changeable
- Nozzle levels can be raised or lowered without excavating
- Bell, mechanical-joint or flange-type connections
- O-Ring seal furnished when specified

MATHEWS HYDRANTS—by R. D. WOOD COMPANY

Public Ledger Building, Independence Square, Philadelphia 5, Pa.

Manufacturers of "Sand-Spun" Pipe (centrifugally cast in sand molds) and R. D. Wood Gate Valves

PUBLIC WORKS for December, 1958



THE HIGHWAY AND AIRPORT DIGEST

Evaluation of Dust-Laying Practices

All additives used in dust control except asphalt require some clay as a binder in the layer which is to be surface-treated with brines, diluted brines, primers, emulsions, tars or asphalt. Preparation for these various treatments varies slightly, but the surface should always be shaped and crowned before application of any palliative. For unstable surfaces, the minimum recommended treatment depth is 6 inches. For dust treatment purposes, any completed course must have a proper crown, preferably of A-Shape, of 0.3 to 0.5 inch per foot, the lower value for asphaltic suppressants. Calcium or sodium chorides, in pellet form, are mixed in and water sprinkled on the loose mix. This is followed by shaping and rolling operations accompanied by continuous wetting. The surface, thus bonded, can then be sprayed with brine or sealed with asphalt. If sulphite is to be used, the loose aggregates are windrowed, sprayed with 50 percent of the sulphite, and mixed; then 30 percent of the additive is added and the aggregate again mixed. After rolling, the remainder of the sulphite is applied as a surface spray.

"Evaluation of Dust-Laying Practices." By D. van Deurs, County Engineer, Atikokan, Ont. *Roads and Engineering Construction*, September, 1958.

Erosion Damage Along County Highways

There are 620 miles of roads in the county road system of Ocean County, N.J. Most of the roads are constructed with a paved width of 30 ft. This provides space of 2 10-ft. lanes for traffic with 5-ft. shoulders. The shoulders and the traffic lanes are all covered with a mixed-in-place bituminous surface making one uniform surface from side to side. The slope erosion problem can be materially reduced by flattening the slopes and seeding. The natural soil on slopes is fertilized, seeded and mulched at a cost of \$0.12 to \$0.15 psy. On slopes in fills on new

roads the top 5 ft. is seeded and in a few years the entire slope becomes seeded because the seeds from the grasses soon spread downward. In cut sections on both new and old roads where considerable erosion and sliding occurs on high slopes, underdrains are constructed to intercept the ground water. To cope with the erosion of ditches it is best to keep the slope of the ditch as flat as possible and get grass to grow on the slopes as quickly as possible. Sand dunes develop on the roads near the beaches. Transplanting beachgrass, wooden slat fences and bulkheads are the methods that are being used to prevent these sand dunes.

"Erosion Damage as it Affects County Highways." By Lawrence F. Wagner, Ocean County Engineer, Toms River, N.J. *PUBLIC WORKS*, November, 1958.

Snow Removal Needs New Ideas

In Clifton, N.J., new equipment and ideas demand that well-organ-

ized ice and snow control programs be modified almost on a yearly basis to provide the degree of service expected by the motoring public. Willys Jeeps equipped with plows save time where it is not practical to use larger equipment. During each ice storm or light snowfall 13 trucks with tailgate spreaders and 4 trucks with Tarco Scotchman spreaders cover 96.5 miles of streets. Each of the first group carries 10 yards of cinders and each of the latter, four tons of salt. During the winter season, the crews prepare all trucks in the last hour of the work day to prevent lost time, should a freezing rain or snow develop through the night. It takes about one hour to get all trucks on the streets after the first call for personnel is made. Each truck driver receives a list of instructions, maps of each section and a listing of streets in the order they are to be covered, a first-aid kit, flashlights, pencils, and other miscellaneous material deemed necessary. The city has a total of 31 plows mounted on trucks, jeeps,

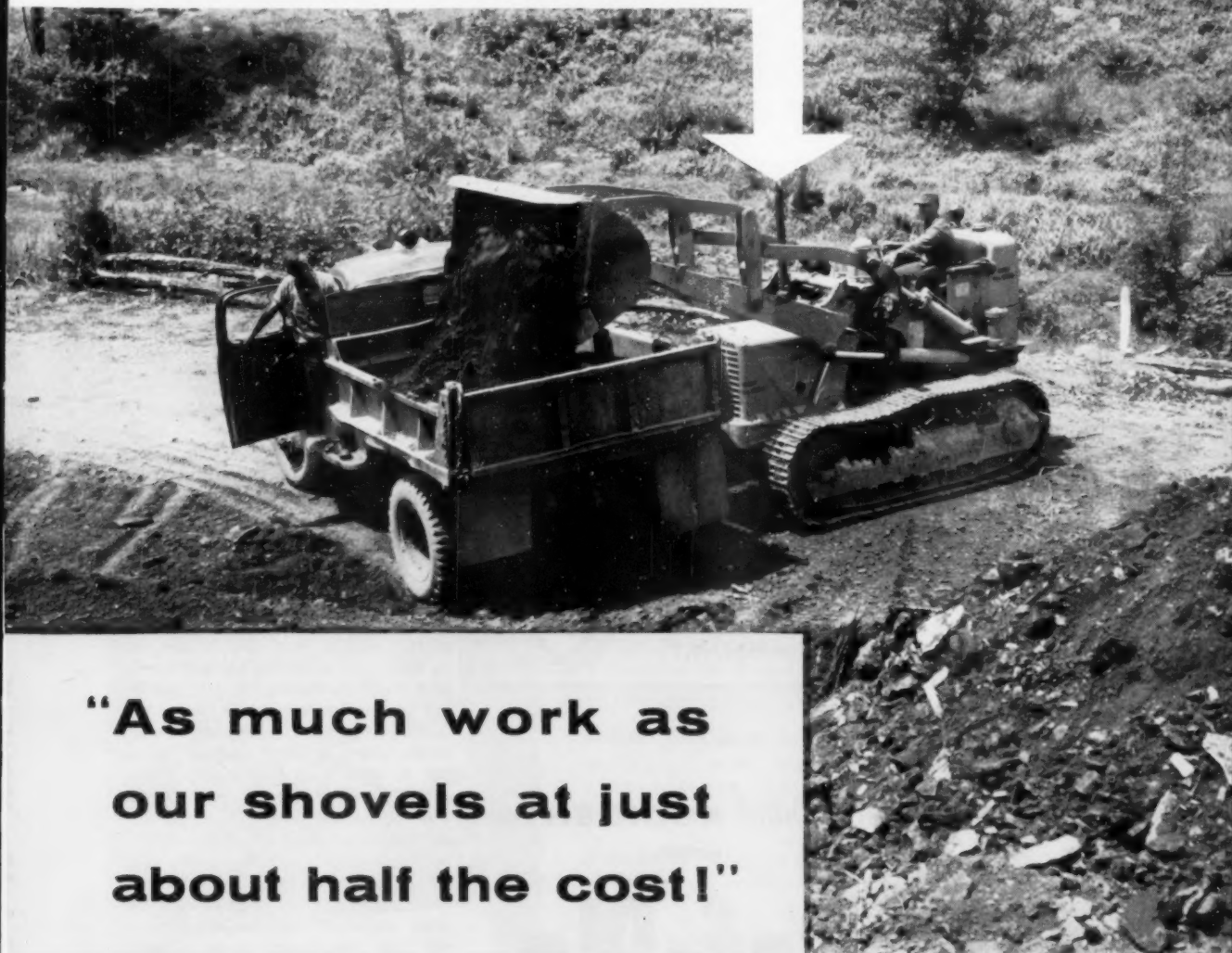
Aluminum Guard Rail Withstands Tests

EIGHT HUNDRED feet of aluminum guard rail were installed as a test section more than a year ago by Reynolds Metals Co. at the Snapper Creek Bridge in Dade County, Fla., near Miami. The railing was developed by Reynolds product development engineers in

cooperation with the Syro Steel Company of Girard, Ohio. The success of this world's first installation has resulted in 7,000 feet of the aluminum railing being specified for the approaches to the Miami International Airport by Howard, Needles, Tammen and Bergendoff, consulting engineers. The pioneer installation of aluminum guard rail was deliberately located near corrosive tidewaters and results of a year's testing indicate that aluminum is satisfactory for this use. In addition to the corrosion tests, the guard rail was subjected to impact tests by an automobile at speeds up to sixty miles per hour. The railing is formed 6061-T6 aluminum alloy sheet in a 12 gauge specification. It is of universal deep beam design and is bolted to concrete posts at conventional 12½-foot intervals. Among the advantages claimed for the use of aluminum are freedom from maintenance problems and ease of handling.



CAT NO. 955 TRAXCAVATOR:



**"As much work as
our shovels at just
about half the cost!"**

The Caterpillar No. 955 Traxcavator pictured above is loading dirt on a one-mile road-building job for the Town of Colchester, N. Y. This hard-working machine is part of a 100 per cent Caterpillar team that includes two D6 Tractors and a No. 12 Motor Grader.

"The No. 955 has proven far superior to the shovels we used to use," says Harry M. Shaw, superintendent. "I believe the No. 955 is doing as much work at just about half the cost!"

There are sound reasons why a No. 955 is one of the most versatile machines a municipality can own. Perfect balance of weight, power and capacity keeps the full length of the track always on the ground. A large load at every pass is assured by the 40° bucket tilt-back at ground level.

Now available on the No. 955 is the new Side Dump Bucket, capacity 1½ cu. yd. It can dump either forward or to the left, and is interchangeable with the standard

bucket—same pins, bolts and nuts used for mounting both buckets.

The new No. 955 (Series E) features new rugged track-roller frame, new solid sprockets, new heavier idlers, and new tough track rollers for the rough jobs.

Your Caterpillar Dealer has three sizes of Traxcavators in his line. Ask for a demonstration of the one best suited to your municipality. You can count on him for fast service and quality Caterpillar parts.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR

Caterpillar, Cat and Traxcavator are Registered Trademarks of Caterpillar Tractor Co.

**BEST BUY IN
TRACK-TYPE EQUIPMENT**

TARCO "Scotchman"®

Getting the Most for Your Money?

Money you spend for Ice and Snow Control — that is?

One city official says: "My 'Scotchman' spreaders help me get the most for my Winter Maintenance Dollar. They're quick and easy to hook up. Convenient to use. The thin, even 'Scotchman'—air blown—salt spread gives **Faster melting action** with a lot less salt. Besides saving real money on salt I have fewer trips to reload—which saves time. After salting I slip off the spreaders and use my trucks for other work. When it comes to getting Traffic-Safe Streets there's nothing so saving as a 'Scotchman'—it's a real dollar stretcher."

Are you getting the most out of your Winter Maintenance Dollar? You can with a "Scotchman". Choice of 3 models to use on any dump or pick-up... no complicated hook-ups. **One Man Cab Control** is optional.

TARRANT MFG. COMPANY

28 Jumel Place, Saratoga Springs, N.Y.



EXCLUSIVE FEATURES: 1. **Cartridge-type Power Unit:** engine, impeller and electric starter-generator is a compact unit—removed or installed in minutes. 2. **Accurate Controls:** over rate of application, over direction and width of spread. 3. **Stainless Steel:** all sheet metal parts touched by salt.

How much are your old, wasteful spreaders worth as a trade-in for a New "Scotchman"? For details and a demonstration see your "Scotchman" dealer or write to us.



tractors, a motor patrol and a front-end loader. Last winter the city used 2,765 cu. yds. of cinders, 5,826 bags of salt and 646 bags of calcium chloride.

"Snow Removal Needs New Ideas." By William Holster, City Manager, Clifton, N.J. *The American City*, October, 1958.

11 Miles of Interstate Designed in 16 Weeks

The Indiana State Highway Dept. and E. S. Preston Associates, Consulting Engineers, demonstrated how modern design tools helped to design 11 miles of Interstate highway in 16 weeks. Tools included aerial photographs, stereoplotters equipped with automatic recording devices, an electronic computer and an automatic continuous line plotter. The state specified a 1¼ mile band for study in route location. Aerial photography was exposed at 6,000 ft. above the ground, giving a scale of 1 in. = 1,000 ft. Ground elevations were known for a total of only 12 points over the entire 11.2 mile flight strip. Four of these points were in the first photograph. A model of this photo was oriented in a stereoplotter and it read coordinates for at least four points in each progressive photo in the flight strip, checking on the known elevations in the middle and end. A topographic map of the length of the project at 1 in. = 200 ft. with 5 ft. contour lines was compiled in a Kelsh Stereoplotter. The consultant first staked the approved centerline in the field, signaling points every 600 ft. so they would show up in subsequent low level aerial photography. A 2,200-ft. wide strip centered on the staked out line was flown at an altitude of 1,500 ft., which yields photographs at a scale of 1 in. = 250 ft. These photos were used to prepare a 1 in. = 50 ft. planimetric map and to obtain terrain cross section elevations.

"11 Miles of Interstate Designed in 16 Weeks." *Engineering News-Record*, September 25, 1958.

Better Emergency Snow and Traffic Procedures

Baltimore's crippling blizzards last winter prompted the city to have a much better procedure for the correlation and coordination of activities in snow fighting. A new Storm Control Center has been set-up in connection with the Radio Control Center in the Dept. of Transit and Traffic. Facilities have been provided so that 6 people may operate a communications center at one time. The Police Dept., Fire Dept., City Highways Dept., the



CUT Playground ACCIDENTS with

Saf-Pla

the new low cost

RUBBERIZED PLAYGROUND

Saf-Pla can eliminate most of the abrasions, bruises and cuts that result from children falling on hard, abrasive or unsurfaced playgrounds. This new rubberized playground surfacing material generally gives kids a "bounce instead of a bruise" and is not expensive. Playground directors, wherever Saf-Pla has been installed, report a sharp decrease in accidents or, in many cases, **NO ACCIDENTS AT ALL.** Saf-Pla can be applied to black top, concrete or other properly surfaced areas. You owe it to yourself and your school or department to get the facts on this safer, more modern playground surface.

write for bulletin no. 12M...

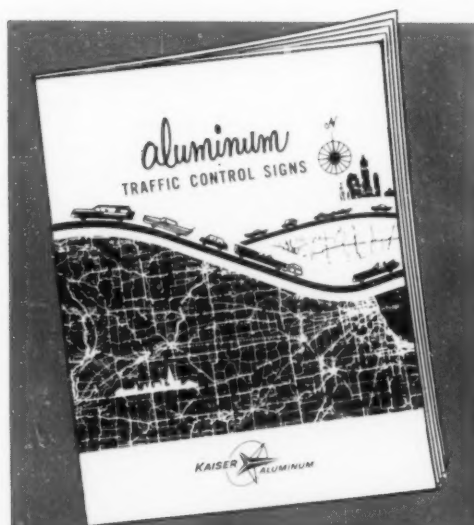
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RUBBER RECLAIMING CO., INC.

BOX 365 BUFFALO 3, NEW YORK



NO OTHER SIGNS *install so easily...last so long...require so little upkeep...or make such an ideal base for message materials. When you consider their savings...compare their light weight, strength and corrosion resistance...could you really afford anything else* BUT ALUMINUM?



Signs made of Kaiser Aluminum are easier to handle... cheaper to ship... because they weigh only half as much as wood or steel.

Kaiser Aluminum provides 5 times the life of wood, 4 times the life of steel. Tests prove it will last for over 20 years with little strength loss.

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Rensselaer County Health Dept., N.Y.

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Deputy Commissioner of Transit, and two other positions from the Transit Dept. are provided positions in the Control Center. Direct telephone lines, which require no dialing or switchboard operation, have been installed between the 6 positions and the Civil Defense Organization, Highways Department, Police Call Box System, Police Radio Room, Gas and Electric Company, two shops of the Dept. of Transit and Traffic and the Transit Company. The Radio Communication Center is equipped with U.S. Weather Bureau teletype, as well as a complete set of Bendix weather instruments. The Police Department is acquiring additional wreckers for the handling of stranded cars; standby contracts are being prepared with private contractors for additional equipment and the Dept. of Public Works is purchasing nearly \$500,000 worth of additional snow-handling apparatus.

"Out of Baltimore's Crippling Blizzards—Better Emergency Snow and Traffic Procedures." By Henry A. Barnes, Commissioner, Dept. of Transit and Traffic, Baltimore, Md. *Street Engineering*, October, 1958.

County Gets Good Roads at Modest Cost

Gunnison County, Colo., has begun a program of salt stabilization for the base and a double asphalt penetration treatment for the surface on its county road system. It built an 8-mile section of this type of construction for \$45,000. Of this total, \$23,000 was spent for salt stabilization and the double-shot asphaltic surface treatment. The remainder of the money was spent in preparing a new roadbed, improving sight distances and eliminating sharp curves. A decomposed-granite-gravel base was built to provide a finished road width of 24 ft. Bulk salt was delivered by truck and spread with the help of a fantail spreader. The salt was laid at a rate of 1 lb. of salt per sq. yd. per in. of compacted base thickness. Mixing was started by scarifying the salt and gravel base to the full depth of the treatment. Water was added direct by a hose hooked from the mixer to a connecting water-tank truck. The final pass by the mixer was made across the 24-ft. surface in 5 overlapping courses. Simultaneous tight blading with a motor grader helped the compactor to knead the base down to a firm compaction. The curing period on this job was 8 days. The surface treatment consisted of 0.3 gal. psy of MC-3 asphalt and this was followed by a 20-lb. psy application of chips.

A 0.2 gal. psy application of MC-3 asphalt was put over the top of the previous application and another 15-lb. chip application followed.

"County Finds a Way to Get Good Roads at Modest Cost." *Better Roads*, October, 1958.

Early American Bridges

The many different types of early American bridges that have been built are covered in this article. Stone bridges are found on many highways in the northeastern section of the United States. The railroads have many notable stone bridges that have stood for many years. The simplest early American wooden bridges were pile-and-trestle spans which crossed the coastal rivers. The first trusses used in wooden bridges were primitive affairs based on the triangle. They were built all over the country in both long and short spans, and open wooden trusses of the kingpost and queenpost variety may be found through the Northeast and Canada. The Town type bridge with its lattice-web trusses outnumber all other types of covered bridges in New England and New York. Another type of truss that was built was the Howe. Wire bridges, as the early suspension types were called, came into use before the Civil War. Most iron bridge designs were adaptations of old wooden trusses. The bowstring wrought-iron arch has withstood many years of use. The first plain concrete arch bridge was built in 1871, and the first reinforced concrete bridge was erected in 1889. The first prestressed concrete highway bridge was built in 1950, and the first aluminum girders were used in 1946.

"Early American Bridges." By Richard Sanders Allen. *Consulting Engineer*, October, 1958.

City Establishes Five-Year Street Maintenance Program

Pueblo, Colo., has 256 miles of streets open to traffic. Of this total, 170 miles have some type of all-weather paving. The paving varies from road-mix asphalt on no base to a high-type asphaltic concrete on a crushed rock base and concrete pavement. In 1957, every street in the city was surveyed to plan a 5-year maintenance program for all surfaced streets. The type of maintenance for each street depends upon several factors, such as 1) type of original construction, 2) type of failure or surface distress of the street, 3) amount of traffic the

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An H-5 Hydrohoe with 24-in. dipper trenches for a sewer line in Florida.

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The H-5 Hydrohoe offers interchangeable 24, 36, 48, and 60-in. dippers. Each dipper is reversible to give you two-way dirt-moving action. With the Model H-3 you can get 12, 18, and 24-in. trenching dippers and a reversible 60-in. dipper that makes the hoe a speedy swing loader. The H-3 also offers a 20-in. special utilities dipper for digging holes of greater depth than length.

All dippers (except the large 48 and 60-in.) have the automatic load ejector — a handy time shaver when digging in sticky clay and gumbo.

Your Bucyrus-Erie distributor wants to show you this full line of dippers and all the other money-saving features of the $\frac{3}{8}$ -yd. H-3 and $\frac{1}{2}$ -yd. H-5 Hydrohoes.

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street carries and 4) the type of traffic on the street. Seal coating consists of applying an RC-4 cut-back asphalt at the rate of about 0.2 to 0.3 gal. psy. Sand chips and slag chips are used as cover aggregate. They are usually applied at the rate of 22 pounds psy. The total cost of applying sand and asphalt is \$0.04 psy and cost of slag and asphalt is \$0.063 psy. Competitive bids are let on all new street reconstruction projects with prices varying from \$1.35 to \$1.75 psy complete in place. Most public work projects are financed from the sales tax revenue which averages \$700,000 per year. An average of 12 tons of asphalt patching material is used per working day and the patching material costs the city about \$15,000 per year.

"City Establishes Five-Year Street Maintenance Program." By George H. Fellows, Director of Public Works, Pueblo, Colo. PUBLIC WORKS, November, 1958.

Should I Consider an Electronic Computer?

An electronic computer is only as good as the man who programs and feeds it. If a consultant cannot afford to release one of his engineers to full-time or near full-time computer work, then it is doubtful that he can use an electronic machine to full advantage. To the consultant whose work does not involve recurring complex calculations, the benefits of electronic computation are to be questioned. The machine can work minor miracles, but cannot substitute for engineering skill. A careful, informed approach to the matter of electronic computation will lead to lasting benefits. Hesitation to investigate these benefits may prove costly. And at some point in the future, a consulting firm will find itself hard-pressed to compete without the employment of electronic computation.

"Should I Consider an Electronic Computer?" By Curtis G. Anderson and William F. Hallstead, Whitman, Requaardt & Associates, Consulting Engineers, Baltimore, Md. PUBLIC WORKS, November, 1958.

Other Articles

"A Comparison of Cement Strengths in Mortars and Concretes." By Myron A. Swayze, Director of Research, Lone Star Cement Corp., New York, N. Y. ASTM Bulletin, September, 1958.

"Problems of a County Engineer." Bridges on a budget by using corrugated metal pipe-arches. By George M. Osborne, Commissioner, Jefferson County, Colo. Highway Magazine, September-October, 1958.

"Lighted Bypass Promotes Safety in Small City." Low-accident-rate expressway design attracts through traffic and relieves congestion in central city area. By Weir Routh, City Manager, Temple, Tex. Street Engineering, October, 1958.

"How Communities Benefit from Highway Relocation." To the surprise of many people in wayside communities, the cash register is not stilled when a major highway is moved out of the business district. Street Engineering, October, 1958.

"Maintenance of Roadside Development Plantings on the Connecticut Turnpike." A woodchip mulch is used in roadside development. Public Works, November, 1958.

"The Town Superintendent and Subdivision Control." Close control is needed to insure proper installation of public works facilities in new subdivisions. By Thomas F. Glynn, Formerly Town Superintendent, West Seneca, N. Y. Public Works, November, 1958.

"Snow Preview." Included are six articles on snow and ice control written by engineers in the public works field. Constructioneer, September 29, 1958.

"New Jersey Has Six-Point Program." Congestion and accidents are being systematically reduced in New Jersey by applying a combination of improvements. Roads and Streets, October, 1958.

"Improved Type of Grade-Separated Highway Intersection." By Robert Schumacher, Transit Authority, New York, N. Y. Civil Engineering, October, 1958.

"Soil Exploration for Foundations." By Eldridge B. Ward, Laboratory Engineer, Houston Urban Expressways. Texas Highways, October, 1958.

"Safe Blasting is Practical." By Arthur Gordon, Assistant Chief Engineer, Liberty Mutual Insurance Co. Modern Highways, October, 1958.

• • •

County Road System Data

The road system of Dakota Co., Minn., at the close of 1957, included 200.7 miles of bituminous surfacing; 212.4 miles of gravel surface; 1.0 mile of unimproved; and 0.4 mile of concrete pavement—a total of 414.5 miles. During 1957, 17.75 miles of bituminous surfacing and 22.29 miles of grading and graveling were completed. The average cost of state aid maintenance on 264.0 miles was \$431.98 per mile; and of county aid maintenance on 158.9 miles was \$363.55 per mile. These costs included repairs and replacements; betterments; equipment rental; blading; minor surface repair and cleaning culverts and ditches; and brush and weed control, snow and ice control, traffic services and erecting and removing snow fence. J. E. Gabiou is County Highway Engineer.



Gyro-Flo 125 powering an I-R Paving Breaker for street repair work.

The **GYRO-FLO 125** Compressor handles the jobs your street crews will tackle... faster, more economically

For on-the-job versatility and dependability, you can't beat the Gyro-Flo 125... I-R's 125-cfm rotary portable compressor. Weighing only 2500 pounds ready-to-go with fuel, oil and water, this compact unit compresses ample air power to run the tools most commonly used by your street crews. For example, the Gyro-Flo 125 will operate 3 tampers; or 2 medium Jackhammers; or 2 medium paving breakers.

Like all six models in I-R's Gyro-Flo line, the 125-cfm compressor features Ingersoll-Rand's exclusive Gyro-Flo rotary design. In terms of economical operation and long-term

dependability, the Gyro-Flo is recognized as the standard of the industry. And the I-R line of rotary portables is the largest available: capacities of 85, 125, 210, 315, 600 and 900 cfm... the right size portable for any job.

Ask your local Ingersoll-Rand dealer or representative for more information on the Gyro-Flo 125... or on any other size Gyro-Flo you may consider suitable for your own jobs. Finish every job faster... with an Ingersoll-Rand Gyro-Flo and tools from Ingersoll-Rand's complete and time-proven line of air tools and rock drills.



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The grainless, two-sided GPX Green withstands the worst weather without checking, splitting or grain rise. This CreZon overlaid plywood saves labor in the shop because it works easily and paints quickly.

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Now, you can eliminate the "squeeze" that costly specialty equipment is putting on your budget with just one versatile machine! In a matter of minutes, the powerful, new Work Bull 1001 can be converted from a $\frac{7}{8}$ -cu. yd. Loader to a Ram Pick-Up Street Sweeper, Backhoe (with its own Backfill Blade), Rotary Broom, Angle Dozer, Lift Fork, Swinging Crane . . . then, back to a Loader with Scarifier attachment! And, it performs each of its jobs so well you will think that it is made for just that one purpose!

INSTANT REVERSING, POWER, SPEED, AND MANEUVERABILITY! Besides its unsurpassed versatility, the Work Bull 1001 features instant-reversing without shifting, 60.3-hp engine, full-time power steering, torque converter, five speeds forward and five reverse, individual turning brakes, and dozens of other years-ahead features that will increase your production while actually lowering operating costs!

LOW PACKAGE PRICE FITS ALMOST ANY BUDGET! Despite its advanced engineering, top-quality construction, and exclusive performance features, the Work Bull 1001 is priced very low. In fact, your cost including all its power-matched attachments is less than what you are accustomed to paying for most single-use machines! Better still, you can buy just the equipment necessary for current operations . . . add attachments when you need them. No additional hydraulics are required when you make additions, since the 1001 comes equipped with three-spool bank-type valve (five spool for units with Pick-Up Sweeper).

OTHER MASSEY-FERGUSON POWER-MATCHED PACKAGES include the Work Bull 202 Tractor (40 hp), Work Bull 303 Tractor (54.5 hp), Work Bull Fork Lift, and Davis Loaders and Backhoes . . . plus a multitude of integrated attachments for each basic rig.

For information on the complete Massey-Ferguson line, ask for Brochure G-4. For specific information on the Work Bull 1001, ask for Brochure W-1. Write Massey-Ferguson Industrial Division, 1009 South West Street, Wichita 13N, Kansas.



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Ram Pick-Up Sweeper attachment has 63" broom, gutter brush, sprinklers; dumps into truck.



The Work Bull 1001 as a Rotary Broom has 96" swath, 30° left and right hydraulic angle control.



Davis Backhoe on Work Bull 202 digs at right angles, or flush alongside walls, fences, etc.

THE EXPANDED HIGHWAY PROGRAM

...a County Point of View

JAMES F. MEISNER,

Marion County Engineer,

Marion, Kansas

FIRST WE must remember that our roads and streets are interconnected and expanding. There is no such thing as a street system, a township system, a county system, a state system and a federal system. They are merely parts of the expanded system. Eliminate any one part out of your total plans and you weaken the whole structure. Pinch off any vein and you destroy some part of the body, unless other veins are provided to channel the life-giving blood (or traffic) to the affected part.

Now since I am going to look at the expanded system from the county point of view, I am going to look first at the two most important roads in the entire system. That is the road where a motorist originates his trip and the road where he terminates his trip—the local roads. Without these two roads, the entire interconnected and interstate system would be needless and motorless. Even though these roads and streets might carry only 10 to 20 vehicles per day, their multiplicity accounts for hundreds of thousands of vehicles that are found upon our interstate intercontinental roads. Who can say that they are unimportant in the total program. Too often we hear slighting remarks about these so called one-man roads and one-man streets. You might just as well speak slightly about your fingers or toes; perhaps more realistically, speak slightly about the hair on your head. Who knows how many hairs you have to pull out of your comb before someone will remark how bald you are getting—who knows how many so called one man roads and streets you have to neglect before some one will remark, "I'm going to sell and get out of this community, it's bankrupt." We need to see every road as part of our vast and interconnected highway system, and we must see that system as part of our economic life.

On the other hand, these origin and destination roads might be the best in the world, but if they did not have an excellent expanded

system of crisscross interstate and inter-community roads, our traveling public would have no place to go because they could not travel to diverse points and destinations.

When we realize these two important facts concerning roads, it will bring attention into focus concerning the expanded highway program. Then we find that we can and should support wholeheartedly any program that will include the entire expanded system, and we must reject any program that does not include in its planning the entire expanded system.

Economic Value of Roads

If we will place proper emphasis upon the economic value of all roads we have our mind in focus. Then we will see the need for the limited access main arteries, the high caliber minor arteries, the medium standard main veins and the all-weather graded and drained roads and streets of the most minute vein. We won't bluntly say, "Let's use all our money on limited access," and we won't demand too high caliber construction on the farm to market road. We will see the whole as an expanding highway program, as a complete body of economic life, with each part demanding special attention.

I am sure I do not have to take any time to go into standards of construction of the various parts of our total system. The only point I think should be stressed is that the State and Federal Departments should not overlook the need for adequate improvement of the minor veins of our economic system and that the county departments see the need for the high type limited access roads and not resent the special attention given, and money spent on these roads. In other words, the county does have a point of view entirely different from that of the State and the Bureau of Public Roads—and we must have meetings so that we may see the points of view of each other and think of our problem in the total picture of National economic life. From my point of view, as a county engineer, I feel that every producer in our economic life must have an all weather road to his point of production, but I

also feel that some demands for high standard roads on our local level are not warranted. Also, that economically we might not be able to justify the cost of the surfacing of some minor vein roads—but again it is like the veins in our body, in how many cases can we restrict or deny the economic life-giving all weather traffic, before we hurt the whole body.

Our job, then, is basically not to sell our local roads short. They and the local streets originate almost every vehicle on our State and Federal highways. We should join hands with the State and Federal authorities and team up together and in a cooperative effort, strive to do the best possible on our individual roads and support vocally, physically and economically the work of all the partners in this interconnected and expanding road net work.

We must study the problems and be ready to justify the relocation of highways, the interchanges, the restricted areas along our highways, zoning along the highways, advance purchase of right-of-way and, in general, the high type of design and reconstruction required, not only in the interstate program, but in our state, county, city and township programs.

Physically, we must see from the county point of view that our all important feeder and destination roads are ready to channel traffic on and off the interstate roads smoothly and safely. We cannot justify doing nothing about the complaint we hear so often nowadays that a taxpayer toured 5,000 miles over the continent and had to put on his chains to get the last 2 miles to his home. We must handle our end of the program so that all people can use the interstate and interconnecting system of expanded highways regardless of the weather. We must see that our people have adequate access and we must use good judgment as to what is adequate.

We must be ready and able to justify the closing of purely local roads abutting the interstate system and advocate relocation of some of our roads to eliminate expensive subways and overpasses on our non-important local roads. On the other

hand, the state and the Bureau of Public Roads should take us into their confidence and arm us with the proper facts concerning these needs. From the county point of view I do not feel justified in blindly defending the actions of the state or Bureau if they do not supply me with sufficient information to justify their design.

We must be ready to cooperate in integrating our system into the expanding system when it is in the best interests of the entire public.

Economically, we in the county, must join hands with the men and organizations that have the responsibility of financing the system of expanded highways. We must justify the cost of the project and justify the levying of necessary taxes to pay the costs. Already we see in our State Legislature, and we notice some tendency in the National Legislature, to be hesitant about levying the necessary taxes. Can you blame our Legislature if we merely submit our program and not justify our design.

Finally, from the county point of view we must realize that, as county engineers, we are the "grass roots" contact of the entire engineering profession with the general public and wield no small influence in the molding of public opinion in the matter of engineering and of all roads. If our views are progressive and forward looking when it comes to roads, then in all probability the general public's view on roads will be progressive and forward looking in our county—and just as the hundreds of origin and destination roads build up the traffic on interstate roads, so the 105 counties of Kansas build up the general public's view of the total road program in Kansas.

Yes, we in the county have a responsibility toward the interstate highway program, just as the state and Bureau of Public Roads have a responsibility of taking us in their confidence, and defending the local roads and streets. That county responsibility includes, not only the realization of the importance of roads at our own level, which should make us proud of our own particular job; but our responsibility also includes the support of all those who are building the middle part of our vast network of the expanded system—that necessary part of our economic lifeline between the start and finish of every trip.

This paper was given at the Kansas Highway Conference at Manhattan, Kansas, last spring and has been slightly condensed here.

On Penn Turnpike



Cleveland 110 speeds drainage improvement

The Job..... installing 20 miles of drain tile for improvement of drainage along the Pennsylvania Turnpike between Perry and Beaver Interchanges.

The Digging in hard shale under 10 inches of tough aggregate in the shoulder of the pike.

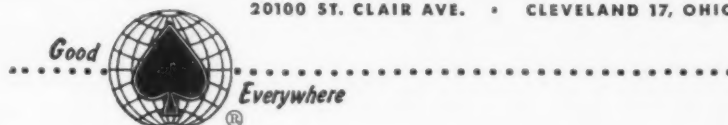
The Record..... the Cleveland boosted daily trench production 300% — to 2,400 feet per day. No other type of machine previously had been able to get more than 600 feet per day.

The Contractor.. Harrison Construction Co., Pittsburgh

accurate...fast...dependable...clean
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The CLEVELAND TRENCHER co.

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PUBLIC WORKS DIGESTS

Prepared by

ALVIN R. JACOBSON, Ph.D.

Associate Professor and Head,
Division of Sanitary Science,
Columbia University School of Public Health

THE SEWERAGE AND REFUSE DIGEST

Digestion

Temperature

Temperature has long been recognized as one of the more important factors controlling the rate and course of digestion of sewage sludge. The author reports on an investigation of the efficiency of the performance of digesters operating at C temperatures of 30°, 35°, 40°, 45°, 50°, 55°, 60° and 65°. The efficiency of the digesters was judged on the basis of the destruction of volatile matter introduced into the digesters, gas production and physical characteristics of the digested sludge. With digesters operating at the temperatures from 35°C to 65°C, inclusively, the percent destruction of volatile matter, volume of gas production and ease of dewatering of the digested sludge surpassed that of the 30° C digester (which is 86° F or near the temperature of many sludge digestion tanks at our municipal sewage treatment plants.) Within the temperature range of 35 to 60° C, inclusively, no significant difference in results could be noted, although the sludges obtained from the 50° C and 60° C digesters were somewhat superior to those from the remaining digesters. The average volatile acid content and the pH within the digesters increased with increase in temperature. However, the composition of the gas, nature of the volatile acids formed and general morphology of the bacterial populations were similar in all of the digesters.

"Temperature Effects on Anaerobic Digestion on Raw Sewage Sludge." By Clarence G. Golueke. *Sewage & Ind. Wastes*, October, 1958.

Building For Tomorrow

Detroit's sewage treatment plant now serves more than 2,667,000 people in Detroit and 34 suburbs. But the task of providing adequate sanitation service for this large and growing metropolitan community is not completed. Detroit has entered upon a \$33,000,000 sewage plant expansion program, which will extend through 1975 and is to be constructed in three stages. Between

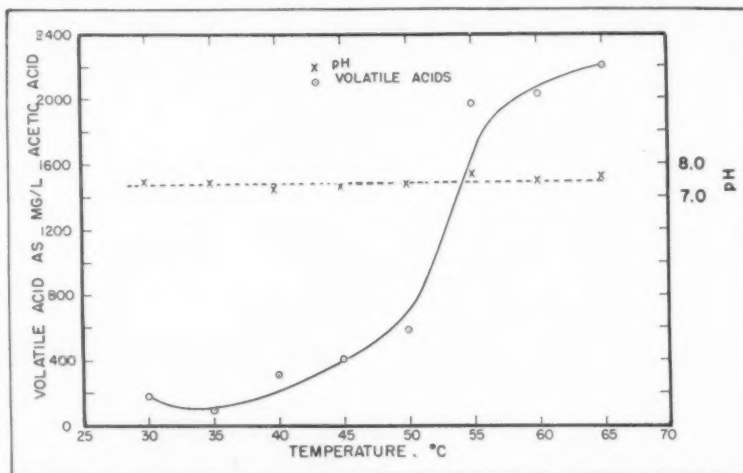
1958 and 1961, \$20 million will be invested to enlarge the treatment plant. Additions to the plant will include sedimentation tanks, a new filter building and additional vacuum filters and an incinerator building and equipment. From 1961 to 1965, over \$5.7 million will be spent for more new buildings and equipment to handle the higher load of waste material the plant will have to process. In the period from 1965 to 1975, \$7 million will be spent to complete expansion of the plant. Since January 1, 1956, Detroit has had an ordinance requiring installation of garbage grinders in every new home, in many types of remodeled dwellings and in commercial establishments where food is processed. In some new suburban areas, most of the homes have garbage disposal units. These garbage grinders have added considerable bulk to the sewage which has added to the cost of treatment. Up to now, customers have not been charged for the added expense of removing ground garbage but a small rate adjustment of 10 cents per 1,000 cubic feet or approximately 10 cents per householder will take effect on January 1, 1959. Detroit is now in the process of negotiating contracts to provide sanitation service to all principal population centers and communities in Wayne, Oakland,

and Macomb Counties. This program to expand sewage treatment facilities will in effect create a single public utility which is capable of providing sanitation treatment for the entire metropolitan area.

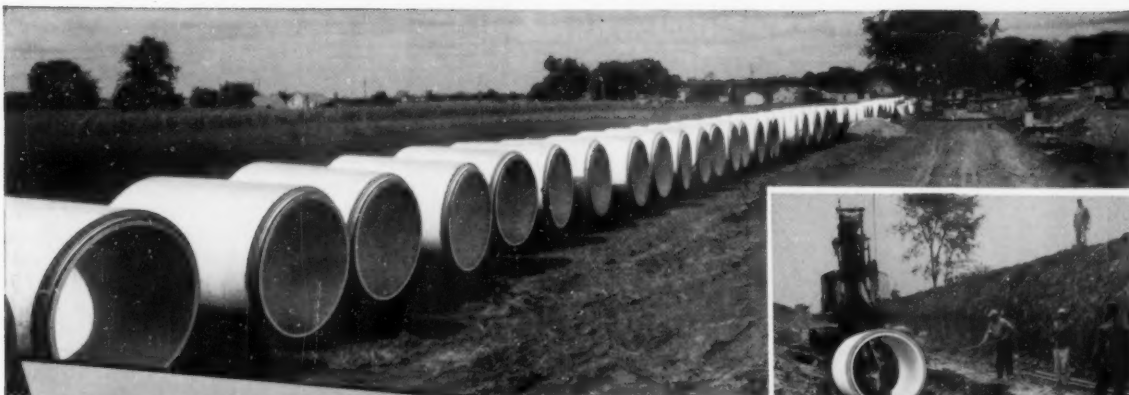
"Building for Tomorrow at Detroit, Mich." By Gerald Remus. *Water and Sewage Works*, October, 1958.

County Refuse Disposal Plan

Contra Costa County, Calif., with a present population of 375,000 and an estimated population of 1,400,000 in the year 2,000, has recently made a study of the problem and methods of disposal of refuse. The problem is to provide and protect a sufficient number of adequate, efficient refuse disposal sites throughout the County to assure service for the present and future population. The County at present is served by no fewer than sixteen different collection companies, plus an unknown number of individual collectors, at collection rates set by the individual companies. All refuse is deposited in any one of approximately 10 disposal sites. The projection of future County-wide needs for refuse disposal sites was carried to the end of the present century and was based upon the following considerations: 1) Existing site capacities;



● EFFECT of temperature on pH and volatile acid content of the digesters tested.



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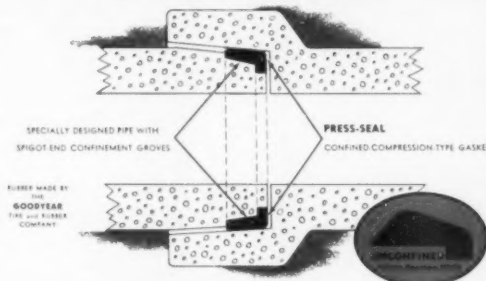
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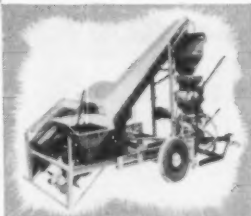
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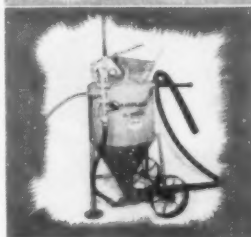
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2) anticipated population growth; 3) amounts and character of refuse; and 4) landfill method of operation. The basic assumption made in predicting population growth was: Topography offers the most logical index to the inherent ability of land to be developed for residential use. Housing density was based on land slope as follows: 0 to 5 percent slope, 14.0 persons per acre; 6 to 15 percent slope, 10.5 persons per acre; 16 to 25 percent slope, 7.0 persons per acre; over 26 percent slope, 0.5 person per acre. The lack of refuse collection data from the private collectors made it difficult to estimate future needs. A study of published reports on refuse disposal was the basis for the following assumptions: 2.16 pounds per capita per calendar day; weight of compacted refuse in place: 800 pounds per cubic yard. These were used in making estimations of future needs. "County Develops Comprehensive Refuse Disposal Plan." **PUBLIC WORKS**, November, 1958.

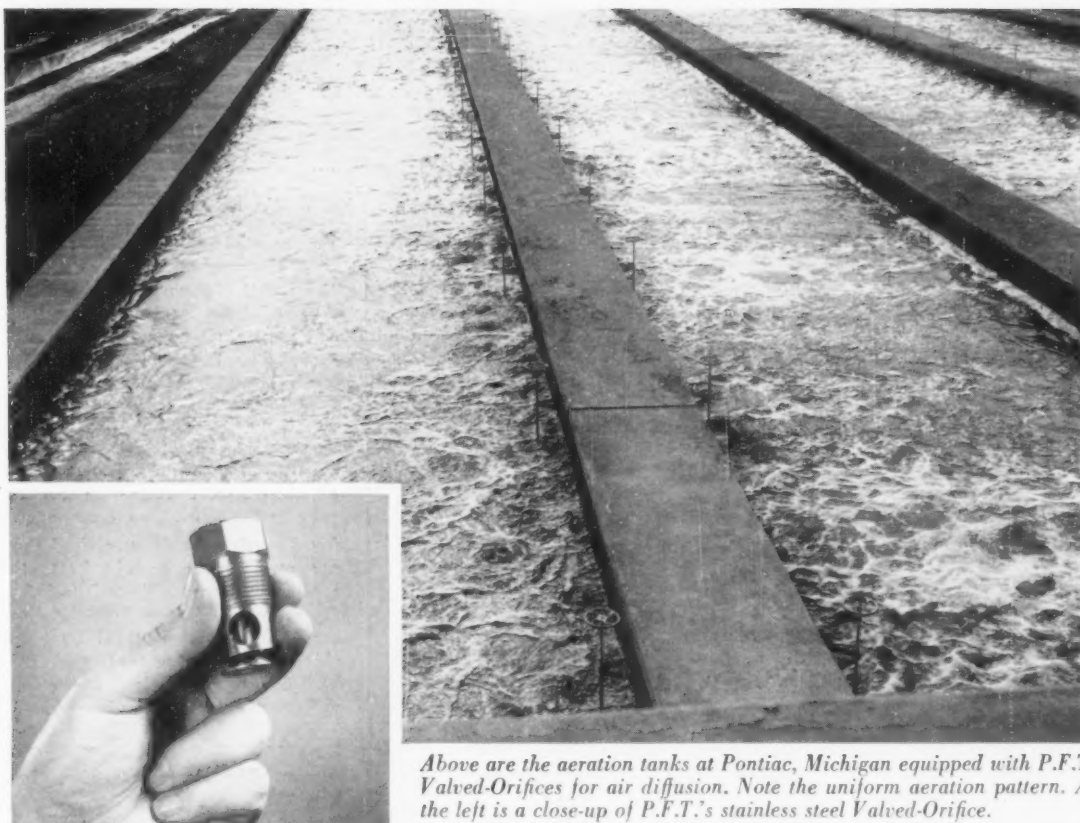
Asbestos-Cement Sewer Pipe

Recently asbestos-cement sewer pipe with five new strength classifications has been placed on the market. These new crushing strengths will permit greater latitude in the design of sewer piping systems and provide greater safety factors for the design engineer as well as simplify the construction of future sewer projects. With the introduction of the five classes of asbestos-cement sewer piping with crushing strengths ranging from 1,500 to 5,000 pounds per lineal foot, the problems of varying trench depths and types of soil will assume a minor role. Under the new classifications, sections of pipe of different crushing strengths, can be readily connected with one another through the simply constructed coupling principle. The new classifications will be utilized to the maximum if the various bedding methods that are used can be obtained simply and economically by the contractor.

"Strength Classifications for Asbestos-Cement Gravity Sewer Pipe." By Daniel F. Altemus. **PUBLIC WORKS**, November, 1958.

Long-Haul Problem

One result of the Los Angeles County ban on home incinerators was the sudden and heavy increase in trash volume that occurred. Over seven years of study went into the collection and disposal problem re-



Above are the aeration tanks at Pontiac, Michigan equipped with P.F.T. Valved-Orifices for air diffusion. Note the uniform aeration pattern. At the left is a close-up of P.F.T.'s stainless steel Valved-Orifice.

PROBLEM: Plugged diffusers at Pontiac, Michigan **SOLUTION: P.F.T. stainless steel Valved-Orifices**

The high iron content and the hardness of the water in Pontiac, Michigan presented an acute air diffuser clogging problem.

The air diffusers required so frequent cleaning that these operations were practically continuous. In conjunction with the city and Jones, Henry and Williams, the Consulting Engineers, tests were made and a number of different air diffusers were tried. P.F.T.'s Valved-Orifices of corrosion-proof stainless steel

have solved Pontiac's problem. They have been in operation without service for over 2 years.

This unique P.F.T. Orifice seats automatically when air pressure is turned off, keeping aeration piping and the rest of the system free from contamination. Wide air dispersal and relatively small bubble size is achieved with P.F.T.'s Valved-Orifices.

Specialized equipment and appurtenances for a complete aeration sys-

tem were supplied by P.F.T. Perhaps we can be of assistance to you; we invite your inquiry.

Waste Treatment Equipment
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Ferri-Floc gives smoother, more efficient and trouble free operation. Whatever your particular water treatment problem may be, you can depend on Ferri-Floc doing a superior job and doing it efficiently and economically—Ferri-Floc is a free flowing granular salt which can be fed with few modifications through any standard dry feed equipment. It is only mildly hygroscopic, thereby permitting easy handling as well as storage in closed hoppers over long periods of time.

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Efficient coagulation of surface or well water. Effective in lime soda-ash softening. Adaptable to treatment of all industrial applications.

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Ferri-Floc coagulates wastes over wide pH ranges —It provides efficient operation regardless of rapid variations of raw sewage—is effective for conditioning sludge prior to vacuum filtration or drying on sand beds.



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sulting in a solution to have the County Sanitation Districts construct and operate sanitary landfills and transfer stations. This would supplement municipal and private disposal operations with the county assisting in the financing. The County Sanitation Districts' long-range goal calls for approximately five landfills and 20 transfer stations. Two landfills are in operation at the present time and are operated in the usual sanitary manner expected for this type of operation. The Districts' first transfer station began operations last January. The refuse is dumped from local collection trucks directly into transfer trailers which travel 23 miles to the Palos Verdes landfill or 35 miles to the Spadra landfill. Each transfer trailer holds 57½ cubic yards or roughly 10 tons of refuse. A truck-tractor and two trailers make up a complete transfer unit with a combined net payload of more than 20 tons. Charges for transfer hauling and disposal are made on a weight basis thus requiring the weighing of each load. Charges are designed to return to the Districts all costs of land purchases, scales, tractors, and other equipment, plus salaries, overhead, and other operating expenses.

"Los Angeles" Answer to the Long-Haul Problem." By F. R. Bowerman. *The American City*, October, 1958.

Sewage Colloids

The authors present a review of previous work on the subject of sewage colloids, an outline of the experimental procedures used, and the results of the studies. Although sewage ordinarily is not subjected to agitation as violent as that produced in the laboratory the authors conclude: 1) The colloidal content of sewage increases when it is subjected to violent agitation, but the increase in colloids is independent of blending time from 1 to 10 minutes. 2) The source of the increase in colloids is in the settleable solids fraction of the solids, but there is no direct relationship between the concentration of settleable solids and increase in colloids. 3) There is no occlusion of colloidal matter in sewage by the coarser settleable solids. 4) Flocculation of colloidal matter may be accomplished by gentle shaking or stirring in 5 hours, but this flocculation depends on the presence of micro-organisms. Sterile colloidal-soluble fractions of sewage (either agitated or quiescent) will not flocculate. 5) Flocculation of colloidal



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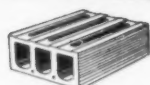
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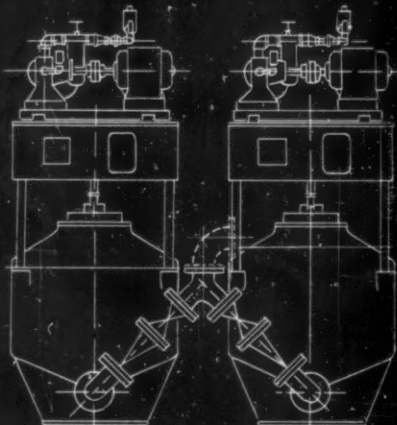
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matter is obtained by ultraviolet light and autoclaving treatment. This work attests to the stability of sewage colloid systems as opposed to the relatively unstable suspended group. The results of these studies also indicate that pre-flocculation and pre-aeration have little or no effect on increasing suspended solids removal.

"Sewage Colloids." By H. Heukelekian and E. Weisberg. *Water and Sewage Works*, October, 1958.

Other Articles

High-Rate Biological Filters—Development and design." Part I. A two-part presentation of a prize-winning paper presented at the Sixth Congress of the Inter-American Association of Sanitary Engineers held in San Juan, Puerto Rico. By F. G. Nelson and K. H. Lanouette. *The American City*, October, 1958.

"Progress and Cost Data in Ohio's Program for Water Pollution Control." A report of the progress that has been made toward water pollution control in Ohio together with some data on costs of this control. By E. B. Ransom. *Public Works*, November, 1958.

"An Evaluation of Stabilization Pond Literature." The authors present a comprehensive review of the literature on stabilization ponds dealing with each of the various facets of this problem. By G. P. Fitzgerald and G. H. Rohlich. *S & IW*, October, 1958.

"State Practices in Sewage Chlorination." This article reports on the present use of chlorine for disinfection in primary and secondary sewage treatment throughout the United States. By Edmund J. Laubusch. *S & IW*, October, 1958.

"Slime Infestation—Literature Review." The authors report on an extensive review of the literature on this subject. By M. E. Harrison and H. Heukelekian. *S & IW*, October, 1958.

"Digester Net Effective Capacity." The author reports on the experience at Arlington, Va. of the installation of the PFT-Pearth Process of gas recirculation which resulted in restoring the sludge digesters to normal operation after considerable difficulty from scum formation. By Leonard L. Langford. *Water and Sewage Works*, October, 1958.

• • •

Chicago Studies Water Filter Operation

Although much is known about rapid sand filters, it still is impossible to construct filter beds that remain free of trouble over long periods of time. The filter beds at the Chicago South District Plant are no exception to the rule, and rebuilding some of the beds will likely be required before many more years

of operation. The cost of rebuilding 80 filters would be high. The engineers in charge were of the opinion this was of such importance that it justified a thorough study of why gravel in filter beds moves about in the filter.

With the aid of a glass side filter 3 ft. by 3 ft. in plan, and a clear-wall plastic pipe filter 6 inches inside diameter, the study was begun in 1956, and intensified in 1957. The work so far has been confined to using aggregate of higher specific gravity than gravel, and observing the flow of the backwash water through the bed. Gravel has a specific gravity of 2.50 to 2.60. Crushed material with specific gravity of 3.0 indicated some improvement over gravel, but not enough to justify the extra cost. Crushed material with specific gravity of 3.30 was some better, though still not a satisfactory solution of gravel mounding in filters. Still higher specific gravity material will be tried, although there is not much hope of obtaining an adequate supply for extensive use in filter beds.

In the study of backwashing filters in a clear wall 6-inch tube and in a glass side filter, much has been learned as to how gravel is moved about in a filter bed. No satisfactory remedy for such trouble so far has been found. Knowing the direction in which to exert efforts, the engineers are going to continue seeking the remedy. A report on "A Study of Filter Backwashing", includes the work up to December 31, 1957. Extensive use of photography has been employed in the work and it has been very helpful in interpretation of the study.

• • •

Color-Film on America's Need for Interstate Highways

This color-film shows in simple, dramatic ways the vital necessity of the Interstate System, to accommodate America's fast-growing population and to aid in the continued expansion of America's great economy. This is a public-service presentation on a very timely subject; a film that is a worthwhile addition to any program.

A showing of this film was made recently to engineers and editors at the Waldorf-Astoria in New York City. The audience believed that a very good job was done by the PCA on preparing this film. Details on obtaining this film can be had by writing the Portland Cement Association, 33 West Grand Ave., Chicago 10, Illinois.

PUBLIC WORKS for December, 1958

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pumps almost everything

(what will go in will come out)



secret:

recessed impeller; continuous open passage

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A propeller type with magnetic drive—
for greatest accuracy!

Easier to Read

Sparling's new Magnetic Drive Masterflo Main-line Meter is the most outstanding advancement in water measurement in years. The Magnetic Drive, a Sparling exclusive, provides advantages never before practical. Positive hermetic sealing greatly reduces maintenance and shutdown time since water and foreign mate-

rials do not come in contact with internal working parts. Almost frictionless in operation, and ruggedly built of corrosion resistant materials, it provides a long life of positive and accurate operation. Investigate today the tremendous advantages of this new meter. Sizes 4" to 24". AWWA 150 or 250 flanges.

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NEW GARAGE PARKS CARS MECHANICALLY

A MECHANICAL garage recently has been completed in downtown Parkersburg, W. Va., which accommodates 264 cars on a ground area of 10,200 sq. ft.; the lot is 100 by 102 feet. Drive-through arrangements reduces possible congestion. Cars are parked in an average time of less than 2½ minutes, including return to the ground floor with another car. Parking is by tower-elevators which pick up the cars at the ground level and place them in stalls on one of the six upper floors.

There are no ramps or travelways. Cars are left on the first floor for parking and returned to the same floor for easy exit. Auxiliary power is provided to insure operation at all times. The structure, which is of structural steel, is partly enclosed at each flow level.

● **HOW it works:** Dolly carries car into elevator (1) where it raises in tower (2) to position (3). The tower is mounted on wheels and travels (4) and (5) to a selected parking stall.

with dark green aluminum panel walls.

Frank Gove, mayor of Parkersburg, was instrumental in the provision of this needed facility which was constructed by Dresser-Ideco Co., Columbus, O.

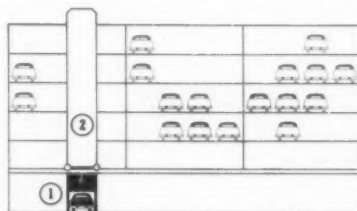


DIAGRAM 1

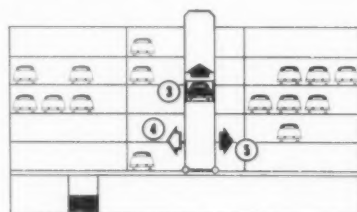


DIAGRAM 2

PROTOTYPE ALUMINUM BRIDGE

THE Reynolds-Baroni Bridge, a new design in aluminum which permits fast, economical erection from standard prefabricated modular units, was introduced recently on the campus of New York University, where a demonstration was made at the test site to a group of visitors from the New York convention of the American Society of Civil Engineers, the International Association of Bridge and Structural Engineers and editors of national engineering publications. Dr. Giorgio Baroni designed the aluminum bridge under sponsorship of Reynolds Metals Company.

The bridge prototype erected on the campus has been subjected to severe structural tests conducted by the Department of Civil Engineering of NYU's College of Engineering. The schedule of tests was planned jointly by NYU and Reynolds in line with recommendations of the Bureau of Public Roads.

J. Louis Reynolds, executive vice-president of Reynolds Metals Company, described the bridge as competitive with conventional structures in initial cost and much more economical in service because aluminum needs little or no protective

maintenance. The components of the bridge weigh about 100 pounds per square foot, their lightness materially reducing the sub-structures required. No falsework and little scaffolding are needed for erection. Roadbed concrete can be poured directly on the upper plate, eliminating most of the expensive, time-consuming job of building forms.

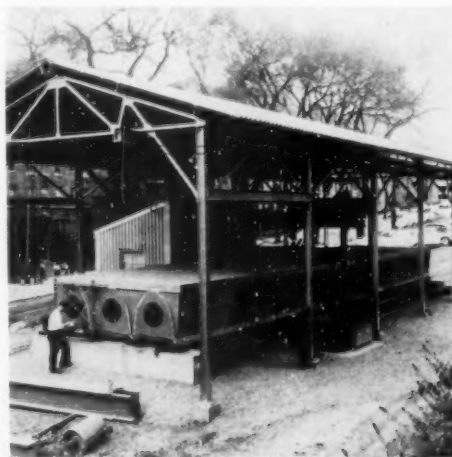
Prefabricated sections are nestable and can be transported economically to any location. In remote areas, the sections could even be flown in by helicopter. Since the bridge uses standard prefabricated modular units, the advantages of large-scale production are always available, regardless of how many bridges are specified in one contract.

The Reynolds bridge consists of parabolic arches stiffened by diaphragms. The four-foot-wide arches are joined, side to side, to form a continuous roadbed of any multiple width desired. Bridge sections between piers can be in excess of 100 feet long. The main structural joints are welded. The arches and most other components are made of annealed alloy 5083 sheet aluminum.

The prototype at NYU is 12 feet wide and 60 feet long. In the severe tests to date it has been given dynamic loadings equivalent to the consecutive passage of 400,000 38-ton trucks. This equals the total service demands the bridge would meet in 40 years of normal traffic, but the tests will be continued for the equivalent of 100 years of service.

The NYU testing device actually places a load of 35 tons—more than 1½ times the design load—on the bridge's single lane 20 times each minute, hour after hour. The bridge's capacity to handle this load proves its strength is adequate for any type of commercial traffic, and even most heavy military movements which might come in a defense emergency.

The tests were supervised by Dr. James Michalos, chairman of the NYU Department of Civil Engineering. He was assisted by Dr. Gerald G. Kubo and Charles Birnstiel of the department.



● ONE-LANE prototype of the new bridge is being tested on campus of New York University. At right, upper surfaces of parabolic arches are seen during assembly.

THE FACTS ABOUT
FRESH SOLIDS DEWATERING

No. 1 OF A SERIES

Thirty-six municipalities are now proving the advantages of raw sewage sludge (fresh solids) dewatering on Coilfilters, in terms of: lower initial investment, ease and economy of operation, lack of nuisance.

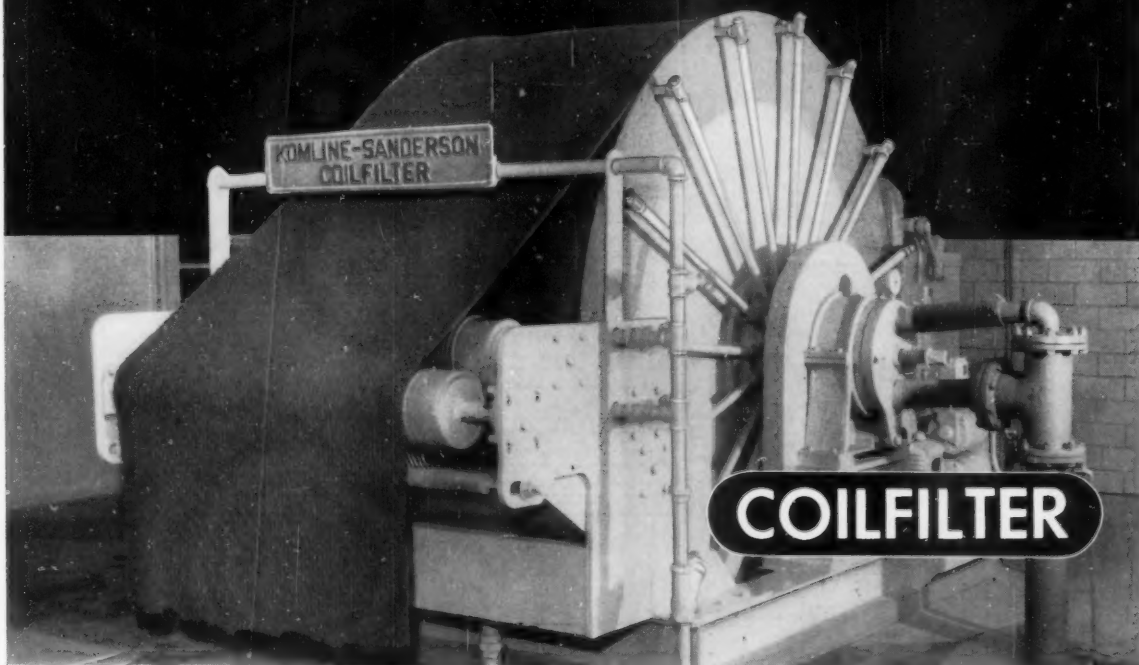
LOW INSTALLATION COST A Coilfilter-equipped fresh solids dewatering plant costs less to install than a system including digesters and sand beds. Fewer structures and less land area are required. The capital investment needed is well within the reach of small and medium-sized communities.

ECONOMICAL OPERATION Operating and fixed costs for a fresh solids dewatering installation are lower than for digestion and drying. Operational problems—and costs—are minimized by the elimination of dependency upon biological processes. Plant compactness requires less labor.

FREEDOM FROM NUISANCE With standard chemical conditioning, dewatered fresh sludge does not produce odor or other nuisance, and bacteriologically is amenable to standard methods of disposal. Absence of digesters precludes overloading.

This is the first of a series of advertisements describing the advantages of fresh solids dewatering on Coilfilters, only sludge vacuum filters successfully and consistently doing this job.

KOMLINE-SANDERSON ENGINEERING CORPORATION
PEAPACK, NEW JERSEY





PUBLIC WORKS DIGESTS



THE INDUSTRIAL WASTE DIGEST

Prepared by

CLAYTON H. BILLINGS

Associate Editor

Spent Sulfite Liquor Disposal

The amount of spent sulfite liquor resulting from the digestion of a ton of pulp varies between 2,000 and 4,000 gallons. The industry has established 90 percent solids recovery as its goal. The sulfur compounds account for 11 percent of the 5-day BOD of the waste and wood sugars are 65 percent. The total ranges from 400 to 600 pounds per ton of pulp. Lignins represent over half of the solids. Among the processes available for treatment or disposal are evaporation and burning; fermentation with yeast; recovery and use as a road-binder for secondary roads and unpaved city streets; fractionation using lime precipitation which ultimately results in the production of vanillin; wet combustion by the Zimmerman process; and lagoon and spray irrigation disposal. A number of agencies are engaged in research on the problem of disposal or recovery; among these are representatives of the industry, the University of Washington, and the Robert A. Taft Sanitary Engineering Center. The Public Health Service experimentation has employed fungi to convert wood sugar to fumaric acid. This can result in 60 percent removal of sugars and 54 percent reduction in BOD. Eighty pounds of fumaric acid valued at \$20 can be produced from the sulfite liquor from one ton of pulp.

"Spent Sulfite Liquor Developments." By Hayse H. Black. *Industrial and Engineering Chemistry*, October, 1958.

New Concepts of Aerator Design

In current aeration practice, only a small percentage of the oxygen supplied is absorbed by the liquid. In this investigation efforts were directed toward a method of producing a high degree of dispersion of air at a low energy requirement. The device selected for experimentation consisted of a rotating disc diffuser suspended vertically in a tank. Air was supplied axially through a hollow shaft and was discharged through perforations in the

circumference of the disc. With air bubbles being produced mainly by shear at the disc boundary, it was expected that the energy requirement would be low.

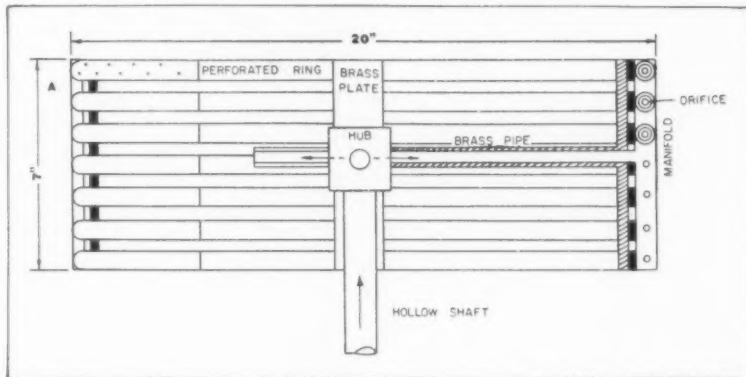
With the success of pilot plant experimentation, large scale investigations were initiated. In these, the device used consisted of seven perforated rings made of lucite tubing mounted separately on brass rings connected to a hollow shaft. The assembly was driven by a submersible motor mounted on the bottom of the tank. From the test results a formula was derived to permit calculation of the rate of oxygen absorption. In the large scale aerator the efficiency of oxygen absorption varied from 12 to 26 percent. It was found that increasing the peripheral speed of the rotor from 586 to 1,150 fpm almost doubled the oxygen absorption efficiency, irrespective of the air flow rate used. For a given set of experimental conditions, the total energy required to dissolve a unit weight of oxygen reaches a minimum value at a certain optimum speed. At the highest air flow rate used (10.4 cfm) and zero DO the total net energy requirement at optimum speed was 0.125 kwhr per pound of oxygen dissolved, for a stream-lined model of the device.

"Aerator Design and Development." By S. A. Zieminski, F. J. Vermillion, Jr., and B. G. St. Ledger. *Sewage and Industrial Wastes*, October, 1958.

Spray Irrigation of Pulp Mill Wastes

To avoid taxing the lagoon disposal system for the kraft pulp mill of the Union Bag-Camp Paper Corporation of Franklin, Va., as a result of expansion of the operation of the mill, the use of spray irrigation of certain segregated mill effluents was investigated. A survey of the various effluents revealed the evaporator and digester condensates and dregs washings from causticizing operations amounted to about 1 mgd. This was about 5 percent of the total wastes volume but 20 percent of the pollution load. This flow was diverted to a separate lagoon area, from which it was pumped through a header and lateral system equipped with nozzles and laid out to cover 100 acres. The application rate amounted to 2,100 gpm for 8 hours on a 10-acre portion once each week. This is equivalent to about 0.45 in. per acre per hr. The soil permeability was very high, handling from 2 to 3 in. of applied water every 12 hours. The use of the effluent increased the pH range of the soil, but resulted in very little change in the mineral or organic content. Crops grown included corn, peanuts, soybeans, and some vegetables, all of good to excellent market grades. Odor problems were not greatly intensified. The total land and installation costs were \$75,000; operating cost was \$25 per day.

"Spray Irrigation of Certain Sul-



Courtesy Sewage & Industrial Wastes

● SIDE VIEW and section of device used in aerator design and development study.

Link-Belt Uniflow settling tank matches efficiency of conventional tanks in

25% less detention time

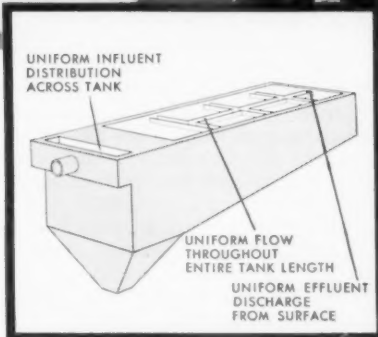
UNIFLOW AT WORK. Modern sewage treatment system uses Link-Belt Straightline collectors in Uniflow settling tanks. Structural aspects of Uniflow design make possible the use of conventional equipment, give flexibility of layout to accommodate site characteristics. Here operator tilts Link-Belt Rotoline scum pipe.



Uniflow with same overflow rate as conventional tank costs less to construct

Combining a rapidly sloping bottom with a system of multiple weirs, Link-Belt Uniflow tank design increases the efficiency of solids removal from water, sewage or industrial liquids. Removal efficiency depends on overflow rate and not upon the depth of the basin. With Uniflow's sloping bottom design, tank volume is reduced as much as 25% while the surface area and resultant overflow rate remain equal to that of conventional tanks. You realize greater efficiency, lower construction and concrete costs.

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14,708

fate Pulp Mill Wastes." By Stuart C. Crawford. *Sewage and Industrial Wastes*, October, 1958.

Air Pollution Is a Community Problem

Originally air pollution ordinances placed prohibition only on dense smokes, of No. 3 or darker density, measured by the Ringelmann Smoke Chart. About 25 years ago revisions were begun in some ordinances to include limitations on dust discharge. At present nearly all ordinances cover all phases of air pollution. Best results in enforcement

programs are achieved when co-operative attitudes are adopted by regulatory agencies as well as by offenders. The human element is important in operation, inspection and maintenance of fuel-burning, process and control equipment; employees should be well-trained. Ordinances usually provide for the regulatory agency to establish and enforce standards for equipment, using a permit system. This type of control is essential, and most manufacturers welcome it as a means of eliminating unfair competition. Adequate control of air pollution is really a major community housekeeping



The Birth of HYDRAULICS

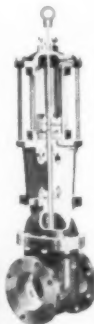
"Eureka!" (I have found it) cried the famous Greek sage Archimedes in the 3rd century B. C., as he discovered the principle of water displacement. But not until the 16th Century, A. D., many hundreds of years later, was the science of hydraulics really created when the French built the famous Fountains of Versailles near Paris.

Because water supplies are vital to life, ancient villages and camps had to be located near lakes or streams. Today, our modern civilization could not exist without the science of hydraulics which makes it possible to convey potable water in large quantities to distant centers of population. Instead of people going to the water, we now take the water to the people.

To a large extent, the men who manage and supervise our modern water distribution systems are unsung heroes. Like the stars in the sky or the cream in your coffee, they are "taken for granted." We believe that they deserve greater public recognition of their service.

This Series is an attempt to put into words some appreciation of the water works men of the United States.

**M&H VALVE
AND FITTINGS COMPANY**
ANNISTON, ALABAMA



project. It should be considered in the same category with road and street and utility maintenance.

"Industrial Air Pollution." By William A. Christy. *Industrial Wastes*, September-October, 1958.

Colorimetric Analysis of Atmospheric SO₂

Because available conductometric methods for measuring sulfur dioxide concentrations in the atmosphere continually are not specific, the feasibility of using colorimetric methods was investigated. The criteria felt necessary for colorimetric measurements in continuous recording machines were determined to be the following: Specificity of reagent for substance, time for color response, stability of reagent and stability of the resultant color. The method proposed by West and Gaeke utilizing sodium tetrachloromercurate with pararosaniline hydrochloride and formaldehyde was chosen for primary investigation. This method is considered flexible and useful for air pollution work. By varying reagent and sample flow rates, concentrations of parts per hundred million can be obtained in areas of low concentrations, and higher concentrations can also be recorded by reversing the ratios of sample and reagent flow rates. In the system used, the range of concentrations expected was from 0 to 5 ppm.

The reagent was found to be sensitive to variations of 0.002 γ of sulfur dioxide per ml. of reagent at low concentrations. In the higher concentrations, using a 1-inch cell, the sensitivity to variation tended to decrease as the limits of the instrument were approached. The pH of the reagent is critical for optimum response. This is believed to be due to the formation of the trihydrochloride of pararosaniline, which is more susceptible to substitution than the mono or dihydrochlorides.

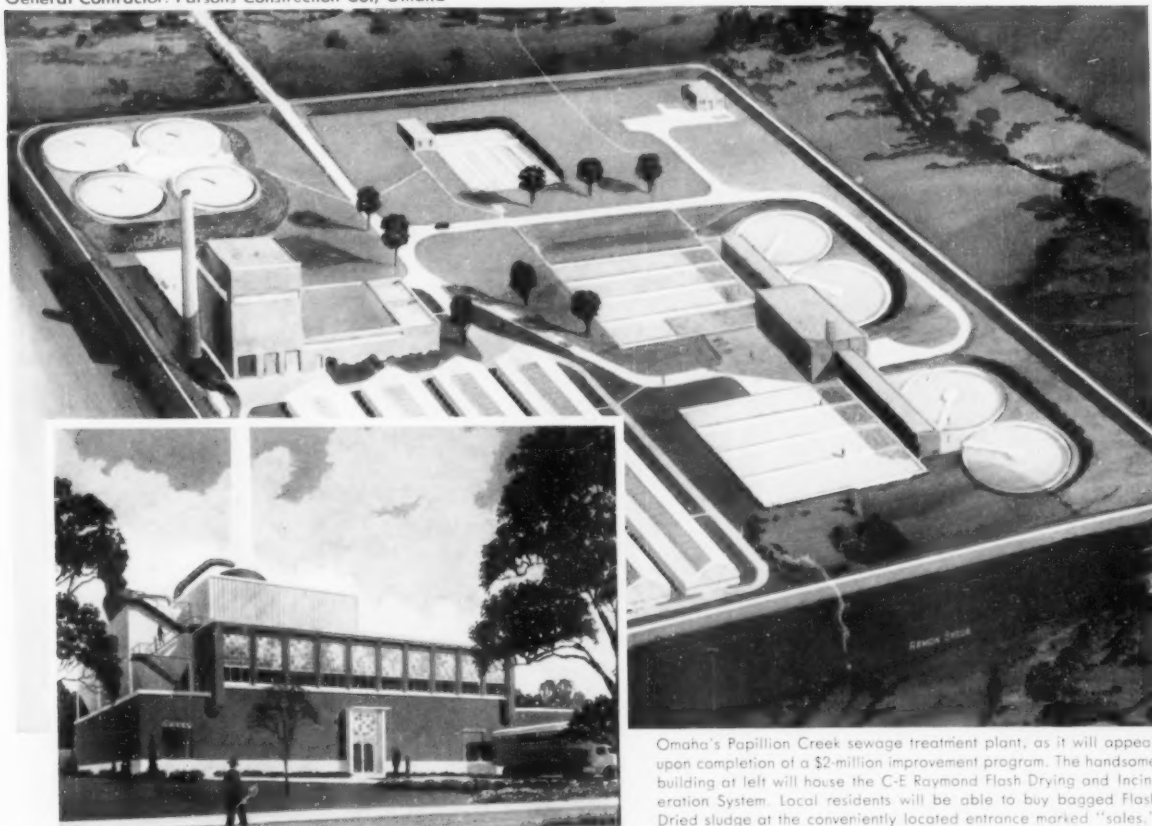
"Colorimetric Method for Continuous Recording Analysis of Atmospheric Sulfur Dioxide." By H. L. Helwig and C. L. Gordon, *Analytical Chemistry*, November, 1958.

• • •

Sewage Treatment and Sludge Disposal in Milwaukee

The activated sludge plant serving Milwaukee, Wisc., treated an average of 158.6 mgd of sewage during 1957, producing 76,227 tons of milorganite fertilizer, all of which was sold. The plant accomplished a reduction of 95 percent in BOD and 94.5 percent in suspended solids.

Consulting Engineers: Henningson, Durham & Richardson, Omaha—Colorado Springs
General Contractor: Parsons Construction Co., Omaha



Omaha's Papillion Creek sewage treatment plant, as it will appear upon completion of a \$2-million improvement program. The handsome building at left will house the C-E Raymond Flash Drying and Incineration System. Local residents will be able to buy bagged Flash Dried sludge at the conveniently located entrance marked "sales."

SELECTED BY OMAHA...

C-E RAYMOND for sludge disposal

Omaha's expanded sewage treatment facilities will serve an equivalent population of 122,500 and will have an influent capacity of 12 mgd. Activated sludge filter cake from this modernized plant will be Flash Dried in a C-E Raymond Flash Drying and Incineration System, reducing it to even-size particles of uniform moisture content.

Selling this product for use as a soil conditioner and using it on municipal parks, lawns, and golf courses will help to defray plant operating expenses. The surplus can be burned to a sterile, clinker-free ash. C-E Raymond is the *only* system that permits both drying and incineration — separately or together — in any proportion.

High temperature deodorization and efficient fly ash collection here will assure that nearby residents are not annoyed by air pollution.

Controlled drying . . . efficient incineration . . . economy of operation . . . high temperature deodorizing and fly ash collecting equipment integral with the system . . . these are some of the reasons communities, large and small, throughout the country are choosing C-E Raymond.

For more information, contact the C-E office nearest you. Our specialists will be glad to discuss, with you or your consultants, how this system can benefit your community.

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C-179

ALSO FLASH DRYING AND INCINERATION SYSTEMS FOR INDUSTRIAL WASTE DISPOSAL

PUBLIC WORKS for December, 1958

157

CLOW OPENS NEW CAST IRON PIPE PLANT

A LARGE NEW plant to meet the growing demand for cast iron pressure pipe for water and gas systems has been formally opened at Bensenville, Illinois, by James B. Clow & Sons, Inc.

Built and equipped at a cost of \$6,500,000, the new facility has more than 100,000 square feet of enclosed floor space and occupies approximately 60 acres. It manufactures cast iron pipe of 6 to 16-in. diameter, in 18-ft. lengths, by the metal mold process.

The plant is highly automated with newly developed equipment for pipe manufacture. Casting machines include original patented designs by Clow engineers, and the control system that governs their operation is unique in the industry.

The main building, 400 feet long and 2 to 2½ stories high, houses cupolas for the melting of iron, centrifugal casting machines, core-making equipment, and maintenance and machine shops. Projecting from this building is a one-story structure 420 feet long in which pipe is annealed, tested and coated. These buildings are constructed of steel framework, with steel sash and plastic skylights. Separate structures include a warehouse, switchgear building, pump house and change house for employees.

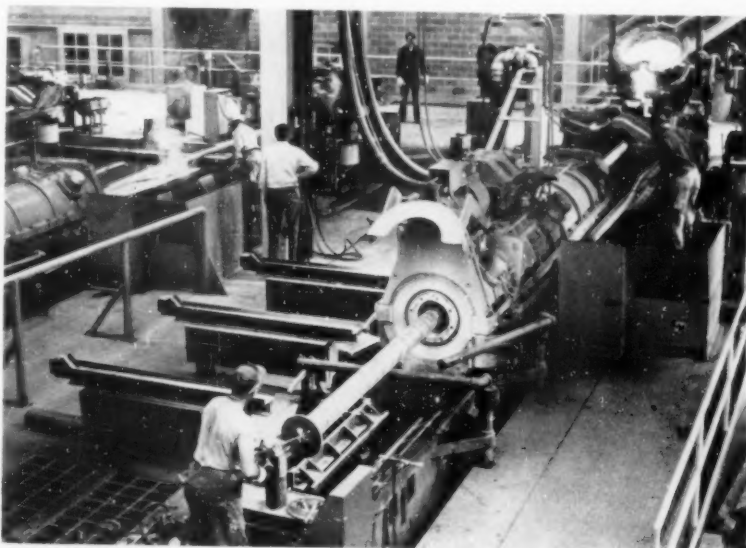
Raw materials, pig iron, scrap iron, coke and limestone are brought

to the plant by rail, weighed in the desired proportion to meet metallurgical standards for high quality pipe, and charged into the 9-ft. diameter cupolas. Melted iron flows out into huge ladles at 2700°F temperatures.

The centrifugal casting machine consists of a water box in which a steel mold revolves while water is circulated around it. In casting pipe, iron is poured into the spinning mold

as the machine travels down a slightly inclined track. The newly formed pipe is stripped from the mold as the machine travels back up the incline.

With this high-speed centrifugal casting, one machine can make 40 lengths of 6-in. pipe an hour. The operation employs an electric eye and is intricately controlled by an elaborate system of safety interlocks. Immediately after casting, the pipe goes to an annealing oven, after which it is cleaned, coated and tested for quality before shipping.



● CENTRIFUGAL force forms pipe in mold of the high speed casting machines.

SNOW REMOVAL TIME CUT ONE-THIRD

BY EQUIPPING its 1¼-cu. yd. "Michigan" Model 75A tractor shovel with a blower, Cudahy, Wisc., handles snow removal in less than one-third the time required for bucket loading. When there is no snow on the ground, the city uses

the tractor shovel for routine construction and maintenance work. In winter, the operator replaces the bucket with a 10-foot V-blade to plow alleys and, occasionally, streets. The "Michigan" takes about eight hours to clear the 13 miles of

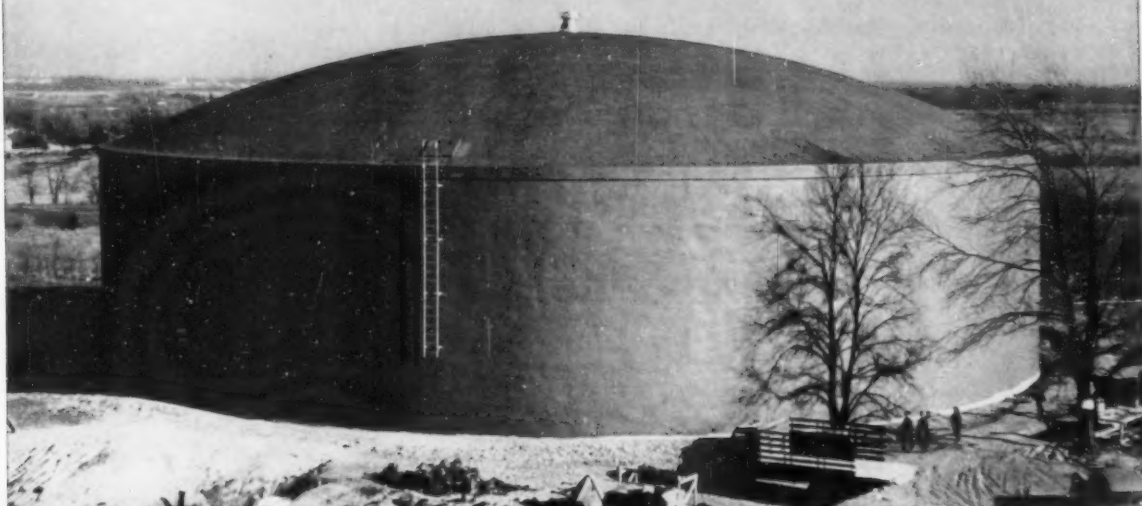
alleys located within the city limits. With the alleys cleared, the next job is to remove curb-windrowed snow from main traffic and business routes. The operator then replaces the V plow with a Sno-Thro blower. This attachment consistently blows four cubic yards of snow into a truck in less than a minute. The City also uses the blower-equipped tractor shovel in undeveloped areas to throw windrowed snow 40 to 50 feet away from the road, thus avoiding need for trucks or truckloading.

Daytime Speed of Passenger Cars

Michigan passenger cars are now traveling at an average daytime speed of 56.5 mph on state trunkline routes. The average daytime speed for trucks is 48.3 mph and for nighttime 50.3 mph. These statistics were compiled by the Michigan Highway Department radar traffic observation conducted at strategic locations.



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Underground Corrosion

RESEARCHES by the National Bureau of Standards on the corrosion of underground structures, carried on for over 45 years, have been marked by steadily improved understanding of the causal factors at work and by the development of increasingly effective means of preventing the harmful effects that underground corrosion produces. An important phase of the work, now essentially complete, has been an extensive field-burial program to determine the specific behavior of metals and coating materials when exposed for periods up to 17 years in a wide range of soil environments. At the same time, other phases of the corrosion program have led to increased information on the electrical and chemical aspects of the corrosion process, development of methods and instruments for measuring soil characteristics, improvements in the technique of cathodic protection, and virtual elimination of corrosion due to stray-current electrolysis.

There are now in this country about 1 million miles of gas, water, and oil pipelines; 170,000 miles of buried power and communication cables; and an unknown number of tanks, pilings, burial vaults and other structures. The annual cost to the U. S. pipeline industry alone, for protective measures and replacements due directly to corrosion, is estimated at \$600 million. A still higher indirect cost results from loss of products, service shutdowns, and loss of life and property by explosion and fire due to leakage from corroded pipes. Furthermore, since corrosion rates are often unknown, engineers have wasted large quantities of material by specifying unnecessarily large thicknesses in their designs.

Most underground corrosion is the result of electrochemical reactions. For such reactions to occur there must be a potential difference between two points of the metal in contact with an electrolyte. Current flows from the anode area through the electrolyte to the cathode and returns through the metal to complete the circuit. The anode area corrodes through loss of metal ions to the electrolyte.

The chief contributing factors are the presence of moisture, oxygen and soluble salts in the soil, and the permeability of the soil to these

substances. Moisture provides the soil electrolyte which is composed of hydrogen and hydroxyl ions from the water itself, and a variety of ions from the salts dissolved from the soil. These ions determine the electrical resistivity, as well as the chemical properties of the soil. Oxygen, from the air or from oxidizing compounds in the soil, stimulates corrosion by combining with metal ions. If the resulting corrosion products are soluble or otherwise removed from the anodic areas, corrosion proceeds; if they accumulate, they may protect the metal against further corrosion; or, if they are more cathodic than the bare metal, they will accelerate and localize the corrosion.

Other factors which determine the amount of current that flows from metal to soil are the size, number and location of anodic areas. Galvanic corrosion may result because of contact between dissimilar metals, and because of local differences in the packing of the soil which may produce oxygen concentration cells; the regions with less oxygen are anodic with respect to others.

Bacteria must also be considered, particularly the anaerobic sulfate-reducing bacteria that convert soluble sulfates to sulfides. These are most active in poorly aerated swamp areas where the pH of the soil water is about neutral and there is enough organic matter and soluble sulfates for the organisms to thrive.

Soils and Burial Procedure

The 95 soil types used in the field program show wide differences in physical and chemical properties. In texture, the soils vary from soft, spongy peats through soft clays, loams, and silts to coarse-grained sands and gravels. The resistivity ranges from 51 ohm-cm, approximately that of sea water, to a value over 1,000 times larger, indicating the absence of soluble salts. Chemically, the soils range from extreme acidity (pH=2.6) to high alkalinity (pH=10.2), and from highly oxidizing to definitely reducing. In addition, there are striking differences in the kinds and amounts of soluble salts present.

In the first extensive burials (1922), specimens of commonly used ferrous pipe materials were buried at 47 test sites. In 1928, similar fer-

rous materials and some copper and copper alloys were buried in a new group of sites; and a burial program was also started on bituminous coatings. Between 1932 and 1941 additional burials were made of high-alloy irons and steels, copper and copper alloys, zinc, alloys of lead, lead-coated steels, galvanized iron, tin-coated copper, various nonbituminous organic coatings, and asbestos cement pipe.

As a rule, 10 or 12 specimens of each material were buried at each site, and 2 specimens were removed periodically, so that corrosion data were obtained for maximum exposures of 12 to 17 years for all materials. Specimens were usually placed in a single row and were arranged so that 2 samples of each material could be removed without disturbing the specimens still in the ground. Exhumed specimens were treated in the Bureau's corrosion laboratory by chemical and mechanical procedures to remove the corrosion products without significant loss in weight or mechanical injury to the uncorroded metal. Measurements of weight loss and pit depth were then made.

The field test results for plain ferrous metals, as well as those for low-alloy steels, exhibit very clearly the controlling influence of the soil on the character of the corrosion patterns when buried in the same soil, but the type of corrosion varied widely in different soils. In general, a high initial corrosion rate decreasing after a few years to almost complete cessation is found in well drained soils with high resistivities; while the corrosion rate is nearly constant after the first year or two in poorly drained soils with low resistivities.

Data were obtained on the following low-alloy steels: Copper-bearing steel; copper-molybdenum open-hearth iron; nickel-copper steels; and steels containing from 1 to 6 percent chromium with and without molybdenum.

The general effect of the alloying elements was to lower the initial rate of weight loss, but to increase the initial rate of pitting, as compared with plain carbon steel. Except in very poorly aerated and reducing soils, however, the pitting rate diminished more rapidly for the alloy steels than for plain steels. Chromium and molybdenum were

particularly effective in reducing the corrosion of low-alloy steels in the most corrosive site, a cinder fill.

The higher-alloy steels tested contained up to 18 percent chromium, with and without nickel and molybdenum. Increasing the chromium content caused a gradual decrease in weight loss, but pitting was accelerated by additions of chromium beyond 6 percent. The tendency of high concentrations of chromium to accelerate pitting appears to be neutralized by adding sufficient nickel to produce steels of the austenitic type.

Copper, Brass and Lead

Results on copper and copper alloys indicate that tough-pitch copper, deoxidized copper, copper containing up to 3 percent of silicon with and without tin, and red brass (15 percent Zn) all behave essentially alike. Soils, including cinders, with high concentrations of sulfides, chlorides, or hydrogen ions were found the most corrosive toward these materials.

The corrosion rate of Cu-Zn alloys with more than 27 percent zinc increased approximately as the amount of zinc and was generally accompanied by dezincification—except in soils with moderate or high

concentrations of sulfide. In the sulfide soils the corrosion rate decreased with greater zinc content and dezincification did not occur.

Chemical, antimonial, and tellurium lead showed no appreciable differences in corrosion behavior. The corrosion rate of each tends to increase with decreasing aeration of the soil.

To compare the corrosion resistances of plain iron and steels, copper, lead, and zinc, the soils were divided into 4 groups: Well aerated; poorly aerated; alkaline; and high in sulfide or sulfate. When corrosion-time curves were plotted for specimens buried in representative soils of these types, it was found that plain iron or steel corroded much more rapidly than the other metals in all the soils except the one high in sulfate. In this soil zinc corroded more than steel; but only lead could be expected to withstand for long the corrosive action of such a soil.

In the well aerated and poorly aerated soils which are representative of most of the United States, copper showed the highest corrosion resistance. This superiority is especially marked in the poorly aerated environment, where the corrosion rates of iron or steel, zinc

and lead are proportional to time. In the well aerated environment, the rates of corrosion of the same metals decreased rapidly with longer periods of exposure.

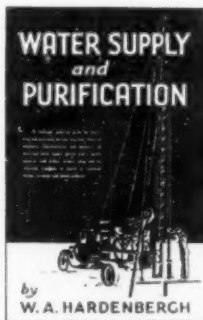
Field tests on galvanized coatings over iron and steel showed that a 2-oz/ft² coating of zinc was sufficient protection in inorganic oxidizing soils, 3-oz/ft² was needed in inorganic reducing soils, and still heavier coatings in high reducing organic soils.

Coatings of vitreous or porcelain enamel revealed no signs of deterioration in 14 years' exposure. Baked phenolic coatings showed marked superiority to air-dried phenolic coatings in preventing pit formation in the underlying steel. Rubber and rubber-like coatings were also very successful, mainly because of their large thicknesses.

Since the early 1930's, the method of cathodic protection has come into more and more extensive use as an alternative or supplement to protective coatings. The method consists in impressing electromotive forces on the underground structure so that the entire structure remains cathodic to the soil at all times. This prevents positive metal ions from passing into solution, and thus blocks the corrosion reactions.

Water Supply and Purification

by Col. W. A. Hardenbergh



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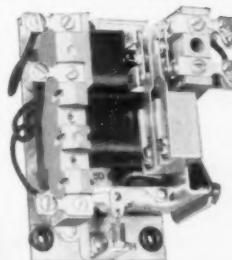
Among the major changes introduced in this latest edition are the following: the chapters on ground water, on filtration, and on laying pipe and maintenance lines have been almost completely rewritten; the chapters on pipe conduits and on disinfection have been revised to bring the material in them up to date and a new chapter has been added on fluoridation.

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THE HEART AND brains in the operation of a power generating station are embodied in the system used for the control of the diesel, hydro, or turbine generators, the boilers, and the auxiliary machinery and apparatus used in the production of electric power. The large investment in power plant equipment represents, generally, the major portion of the overall electric system and far outweighs the investment in transmission, distribution, and general plant facilities for the average system.

In view of this concentration of system funds and equipment, it is of primary importance that the control scheme used for the operation of power producing equipment be designed to permit maximum economy and efficiency in plant operations. This is especially true in view of generally rising costs, coupled with the desirability for holding electric service rates at present levels. One means available for increasing plant efficiency and operating economy may be found in the partial or total centralization and automation of plant controls. The design and arrangement of a control system to achieve these results will vary considerably, depending on the size and type of individual plants, the kind of equipment contained in the plants, the type of control already in existence, and related matters. Such systems may range all the way from a simple gauge board located near a low-pressure turbine generator, and a separate control panel with simplified instrumentation and manual or semi-automatic controls at the front of a stoker fired boiler, to the extremely complex and efficient automatic controls associated with large, high pressure and high temperature turbine generators supplied with steam from boilers burning gas, oil, and crushed or pulverized coal in infinitely variable proportions.

Although there are many plants today which are operating quite successfully with diversified control stations, (with operators stationed

respectively at the switchgear control panels and at remote boiler and turbine panels), the present trend is toward the centralization of these control functions in a single control room. Regardless of the type and size of plant, the inherent advantages of centralization of plant control are of sufficient importance that consideration should be given to consolidating plant operations at a central control point whenever system planning contemplates a major plant addition or the modernization of existing control schemes.

Among the advantages of centralized control rooms are the following:

1. All important plant operations, functions, alarms and indications are brought to a common point, permitting rapid determination and correction of a faulty condition and co-ordination of emergency measures by the operator.

2. Fewer operators are required to observe these functions and to control plant equipment, releasing plant personnel for other duties and reducing the cost of station labor.

3. A common control room, with adequate lighting, air conditioning, and sound proofing is more conducive to proper action in emergencies by plant operators. Filtered air, free of dust, reduces maintenance and improves the operation and reliability of control and protective relays, instruments, and meters.

The manufacturers of control equipment and instrumentation offer highly developed apparatus and devices custom tailored to cover the entire range of plant equipment. It is essential to protect such equipment against damage, but the means to provide that protection will depend on the size of plant and the relative economies of plant labor costs versus the cost of the protective control scheme. It is possible, for example, to inspect the condition of the flame in the furnace of a boiler by peering through inspection ports in the walls of the furnace. Inspection could be provided on a continuous basis directly within a central control room through the use of closed circuit industrial television equipment.

In a similar manner, consideration of centralized controls for the

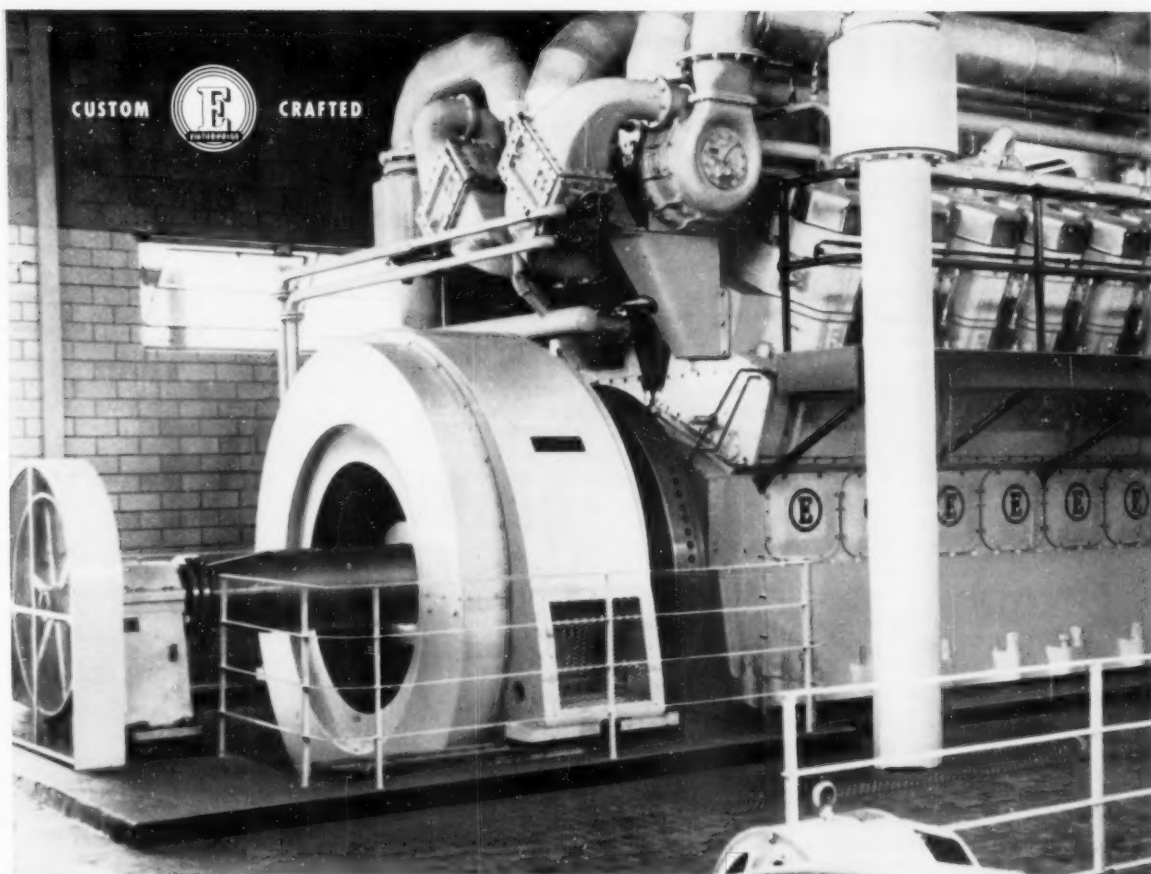
larger and more complex central station might well include an analysis of the economics associated with the use of automatic data-logging equipment to relieve the operator from the routine duty of manually recording operating log data.

Within a centralized control room, there are many arrangements and combinations of control panels and apparatus which are suitable for the operating conditions associated with a given plant. One such arrangement which is popular in many plants consists of control consoles, waist high, which are located on the floor of the control room with an aisle space between the rear of the consoles and the back wall of the control room. Upright panels of the duplex walk-in type are flush-mounted on the wall, with access to their interior from outside the control room.

In general, the generator, turbine, and boiler consoles contain the control switches, indicating lights and apparatus necessary for setting and adjusting the manual and automatic controls of their associated plant equipment, and the generator, turbine and boiler duplex panels contain recording and indicating instruments, annunciators, relays and similar devices. The operator's line-of-sight over the top of the low consoles permits a view of all instruments on the duplex panels, and the aisle space between the rear of the consoles and the front of the duplex panels affords the necessary space for changing charts on recording instruments and for maintaining panel equipment.

On individual panels and consoles, the arrangement of controls should be made from the viewpoint of functional plant operations. The arrangement should be made for logical sequential operation, with complete accessibility for controls used most frequently.

Centralized control rooms are not restricted to large plants, nor are they limited to new plants. In existing plants, where changes are contemplated for the modernization of plant controls, consideration should be given to the advantages of the consolidation of plant controls with respect to the requirements of the individual system.



World's Smallest Big-Horsepower Engine Now at Work for Waverly, Iowa

This Enterprise 16-cylinder Turbocharged Dual Fuel Engine is now "on the line" for the Municipal Electric Utility of Waverly, Iowa. It is the largest, most powerful engine ever built by Enterprise—yet its dimensions and weight make it the world's smallest engine in relation to its horsepower output. The Waverly engine is rated 4,890 hp—3,500 kw—at 360 rpm. Top-rated capacity of the RV: 7700 hp at 400 rpm.

Located in Waverly's West Light Plant, the Enterprise unit more than doubles the previous kw capacity of this facility, and is also generating more power than the city's East Plant with its 4 engines and 3 hydro units.

As with other custom-crafted models in the complete Enterprise line, this 110-ton engine offers many advantages which cut installation, operating and maintenance costs. Less bulk makes installation easier, servicing simpler and more economical. Maintenance requires no major disassembly because all working parts are readily accessible from the outside.

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STREET LIGHTING CONTROLLED by RADIO

THE LIGHTING intensity of State Street, Chicago, is now almost four times greater than in the past. Seventy new poles from Lake to Van Buren Streets now produce 15,624,000 lumens of light or 225,672 lumens per pole. This ultramodern system cost about \$500,000. It is the first major lighting system to utilize radio for its control, each pole having its own receiving set in the base where it will get automatic beep signals for turning lights on and off at dusk and dawn.

The unique fixtures were designed by Robert O. Burton. Each pole consists of one tree-like central riser from which branch four graceful arms or luminaires containing fluorescent lamps. The first arm is mounted 24 feet over the sidewalk; the two side arms arch at 34 feet; and the center arm is mounted at 36 feet.

The new fluorescent lighting plan was developed by General Electric and provides in each luminaire six new power-groove lamps designed with "dimples" to produce twice as much light as the usual fluorescent

lamp. Because temperature changes affect the efficiency of fluorescent lamps, the luminaire will employ a completely sealed air cooling system, the first installation to do so. The air conditioning system is thermostatically controlled to provide the optimum amount of light, regardless of the outside temperature. In addition, the luminaire equipment is designed to insure the starting of the fluorescent lamps in temperatures down to 20° below zero. A special plastic enclosure was designed to mask the fluorescent tubes in the daytime and to lend further to the appearance of the installation.

Radio Control

Radio signals are employed as the basis of the new radio controlled lighting system. These beep signals will emanate from a master control transmitter located in the area. Connected to this transmitter there is an automatic coding and timing device which will send out the proper beep code. Radio receiving sets located at the base of each State Street light pole will pick up



● SEVENTY of these special light poles were fabricated by Union Metal.

the beep signals, decode and amplify them and thereby control the lights.

The radio control system has been designed to perform automatically the following functions: 1) Turn on all lights at dusk; 2) turn off a portion of lights at midnight; 3) turn off all lights at dawn; and 4) control festoon lighting (Christmas decorations, etc.). If desired, the automatic control can be by-passed and these functions can be selected manually at the control transmitter.

Automatically controlled General Electric calrod heating units installed at the base of each light pole will maintain correct operating temperatures for the radio receivers so that they will function properly even piled deep with snow and ice.

The poles were fabricated by the Union Metal Co., who also built the present State Street poles installed back in 1926. The central branch of the pole itself is 5/16 in. steel and tapers from 8 ins. diameter at the top to 12 ins. at the bottom where it is then attached at the ground line to a steel base 34 ins. in diameter.

The State Street Lighting Association owns and operates this lighting system.



● ARTIST'S concept of brilliantly lighted State St. in Chicago. In gala "Light Up" ceremony an electronic signal was bounced off the moon to energize the lights.

Sea Water Conversion Plant

The sea water conversion plant for Aruba, an island of 55,000 inhabitants off the coast of Venezuela, was designed and built by Singmaster & Breyer, Engineers of New York. It is the largest single installation in the world for converting salt water to fresh water. It is also said to combine this process with the production of marketable surplus electricity.

Besides 15,000 kw of electricity, the plant will produce 2,700,000 gallons per day of fresh water, far more than enough to supply the average demand of 12 gpcd. The surplus will go to industry; a new hotel and resort development; and a hydroponics farm. The latter, which uses no soil, consists of 12 acres of gravel-filled concrete troughs fed by a scientifically proportioned solution of chemical nutrients. Semi-arid Aruba is the first large community in history to obtain most of its fresh fruit and vegetables from a soilless farm.

Water Usage in Milwaukee

Average daily water consumption in Milwaukee, Wisc., in 1957 was 141.9 mg, representing a per capita use of 170 gallons per day. The highest pumpage for any one day (Aug. 8) was 234.9 mg; the maximum hourly rate of pumpage, 284.4 mg per 24 hours occurred at 2 PM Aug. 8. The maximum hourly rate of consumption, at 6:30 PM Aug. 7, was 334.9 mg per 24 hours. The maximum 24-hour consumption was 235.3 mg on Aug. 7.

Freeway Operations Seminars

A Freeway Operations Seminar for the Southeastern area has been scheduled for Augusta, Georgia, for January 28, 29 and 30, 1959, according to the Institute of Traffic Engineers. A similar Seminar will be held for the Southwest on February 2, 3 and 4, 1959, near Amon Carter Field, between Fort Worth and Dallas, Texas.

Invitations are extended to traffic engineers, planning and design engineers, enforcement supervisors and other city, county and state officials who have or expect to have responsibility for planning or operating a freeway or expressway.

Discussions will be led by a team of experienced engineers and police, including representatives of the Bureau of Public Roads and of departments and authorities around the country with long contact with the problems of operating controlled access facilities.

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INSPECTION and CONTROL of HIGHWAY CONSTRUCTION

R. R. BARTELSMEYER,
Chief Highway Engineer,
Illinois Division of Highways,

WE HAVE found it necessary in many cases in Illinois to resort to consultants for assistance in making surveys and plans, but after the contract is awarded we still look to our own engineers for staking and supervising the construction work. This has created a serious problem for the administrator of every highway department because there is a shortage of experienced construction engineers for such a large and rapidly expanded program. A few years back it was common procedure to assign four or five experienced engineers to one project. Now we are fortunate if the resident engineer has had three years of construction experience before he is assigned a million dollar project.

This is an age of complicated design, freeways, divided highways, huge interchanges, multilevel bridges, great urban expressways—not thirty thousand, forty thousand, or one hundred thousand dollars a mile as in the past but multimillion dollar projects. As an example, Wacker Drive in Chicago, is costing one million dollars per city block. The layman does not realize the time and money consumed in underground work in the metropolitan areas that precedes the construction work on the surfaces such as underground utilities to be relocated; construction of sewers or main drains, some built under air pressure; siphons and water galleries, all of which must be supervised by competent construction engineers.

Control of Construction

It is only by rigid inspection and control of construction procedures that we can be sure of getting a finished highway product that is in accordance with the plans and specifications set up for the job thus insuring that the work will be of the best possible quality. For this control of the work we must depend on: 1) The qualification of the contractor to perform the work involved in the contract; 2) the adoption of adequate specifications covering

all details of the work; and 3) inspection of the work as it is being done.

We have about 500 contractors qualified and approved for highway work, many of whom are from out of the state. Bidder qualifications provide assurance that the contractor has the necessary equipment, organization and experience to carry on the work.

In concrete pavement construction the engineer must inspect the compaction of the subbase; the preparation of the subgrade; the setting of forms; the installation of joints; placing of reinforcing steel; the spreading, consolidating and finishing of the concrete; and the curing. He must make slump, air entrainment and flexural strength tests. He is required to take cross sections of the subgrade and pavement to determine the thickness of the slab at frequent intervals. He must straight-edge the completed pavement to check for smoothness. This is in addition to the preliminary examination and periodic checking of the batching and weighing equipment, hauling equipment, mixer timing device, water measuring equipment and the dispensing device for the air entraining admixture.

Mechanical Operations

Equipment such as the concrete spreader, vibrator, finishing machine and longitudinal float must be adjusted before starting and checked at regular intervals to make sure the pavement will be struck off and finished to the required thickness and crowned surface. The placing of a concrete pavement is now almost entirely a mechanical operation and a serious deficiency in the finished surface may result from lack of proper adjustment in any of the mechanical equipment.

Since paving is mostly a mechanical operation, its control is chiefly a matter of specifying the right kind of equipment and being sure that it is kept in proper adjustment and is operated so that it will produce the desired results. Starting with the proportioning plant, the materials for each batch must be handled and weighed expertly and accurately as called for in the mixture design. The placing of subbase

material, setting forms, preparing subgrade, and the mixing, spreading and finishing of concrete are all performed by mechanical equipment. One of the chief duties of the inspector is to see that each piece of equipment is functioning properly and in coordination with the others.

In concrete bridge construction the operations to be inspected include pile driving and measurement of pile bearing capacity, bearing strength of soil used to support foundations, construction of false work and forms, placing reinforcing bars and proportioning, mixing, placing and finishing of concrete. In structural steel construction the inspection starts with tests of the steel, inspection of the fabrication at the shop and inspection of the erection of the fabricated material at the construction site.

In Illinois, all Federal-aid and state construction work is inspected by personnel of the Division of Highways. Federal-aid secondary work and construction financed by State Motor Fuel Tax apportioned to counties, cities and townships, are inspected by the counties or cities under the general supervision of the state. Each district engineer of the Division of Highways is responsible for the state inspection work in his district. He also supervises the engineering inspection provided by the counties and cities. In 1957, there were about 600 contracts awarded for construction on state and Federal-aid work under the direct control of the State. When work is started on any project, an engineer who is qualified by education and experience to supervise the work is assigned as resident engineer.

The Bureau of Materials handles all inspection of materials used in the work. This inspection may be made at the plant where the materials are produced or at the job after the materials are delivered, and includes the testing of samples submitted to the laboratory.

In the control and inspection of construction work the opinions and viewpoints of both the engineer and the contractor are necessary and vital to produce a good product. The contractor is by necessity interested in keeping the cost as low as possible because his business suc-

cess depends on doing the work efficiently and economically. In many instances contractors have developed new equipment and methods to reduce their costs and these economies have in turn then reduced the cost of work to the state. In order to encourage the development of new methods for improvement of the work and reduction of cost, it is necessary that specifications be carefully written so that the contractor will be permitted to improve his methods or equipment with only such limitations imposed as are necessary to insure good construction practices.

There has been much discussion recently as to whether specifications should control the methods of doing the work or only the final results. For practical reasons we feel that some control of the methods to be used and the equipment for doing the work is essential. However, the specifications should not include unnecessary restrictions and should leave to the contractor the greatest possible opportunity to use his ingenuity in the use of methods of construction which will improve the product or reduce the cost.

Construction Training Program

The resident engineer is assisted by as many inspectors as may be needed. These inspectors may be technicians or they may be young engineers who start with inspection of small work and progress to bigger and more important jobs as they gain experience. In order to help the man assigned to field inspection of construction work we have carried on a training program for the past several years. This is done in connection with the general "In-service Training Program" for the younger engineers in all phases of highway work.

To help carry the summertime work load, we also employ two and three-year civil engineering students. Many of these students, having become familiar with our policies concerning vacations, sick leave, salaries paid, our fine pension plan and the chances for advancement, return to us after graduation. There is also another inducement—those who have had a summer or two experience are, after graduation, started at a salary somewhat higher than a graduate without any experience in highway work.

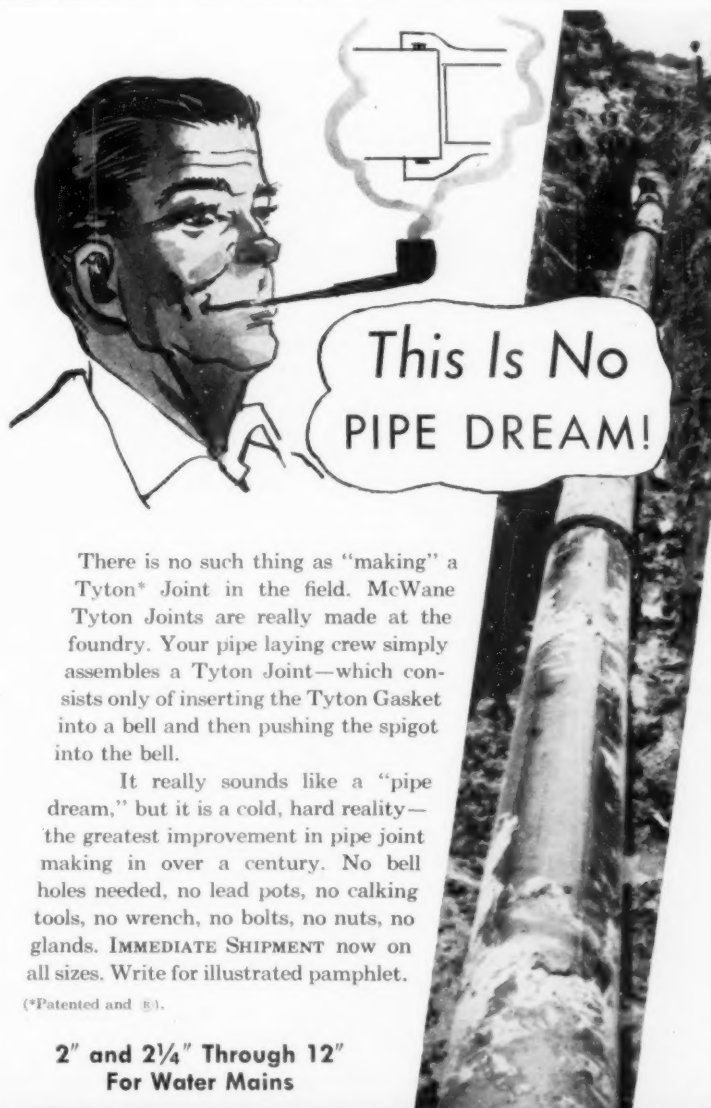
Last year we realized that in order to supervise properly the increased volume of construction with the number of engineers available, some means of relieving the graduate engineers of detail routine duties

would have to be accomplished. We selected, from the results of examinations, about 200 high school graduates. After an eleven week course at the University, they were employed by the Highway Division. They are classified as Engineering Technicians and we find that most of them are demonstrating their ability to perform a valuable service. After two or three years experience, many will be capable of assuming responsibilities as technicians, thus releasing engineers for more important duties.

Field inspection of construction may be regarded as one phase of

highway engineering and it is certainly one of the most important. Good construction depends on the constant vigilance of men qualified by education, experience and judgment to control the operations so that the completed project will be the best possible. When you consider that a modern paving outfit may place as much as \$40,000 worth of work in a single day, it is not hard to see why we regard the field inspection of construction work as being of greatest importance.

This paper, presented at the 1958 Purdue Road School, has been slightly condensed here.



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STORM SEWER FINANCING

Washington State Chapter of APWA Reports on Study of the Problem

TO STUDY THE general problem of financing storm sewers, the Washington State Chapter of APWA, appointed a 5-man committee, with P.N. Royal, Principal Engineer of the Seattle Department of Engineering as Chairman. Three meetings were held, as well as discussions with other engineers experienced in the field. In addition, questionnaires were sent to five California cities, all of which replied. As a result of its work, the committee issued a report containing the conclusions given below; however, since the report is based on Washington State laws and court decisions, the Committee wishes to emphasize that these conclusions may not apply in other states:

1. Each property owner has a moral and probably to a lesser degree a legal obligation to contain the storm water that falls on his property, and any facility which will remove such water from its property without damage to him or to others is a benefit which can be measured in terms of money. Based on the above premise, we hold that property at higher levels derives the same benefit from a storm sewer as property at lower levels.

2. The measurement and assessing of such benefits have been rendered exceedingly difficult by the lack of comprehension on the part of the property owner of his obligation, and the inability of the assessing officer to make the assessment for benefit conform to the yardstick established by the Washington State Supreme Court in the Schmitz case.

Measure of Benefit

The measure of benefit, as roughly defined by the Court in this case, is the increase in value of the property conferred by the improvement immediately after the construction as compared to its value immediately prior to said construction. It is seldom that a local improvement, and particularly one for storm sewers increases the value of property to the extent of the assessment immediately. Time is essential to create this increment.

Some new law, either court decision or act of the Legislature, is definitely needed to meet this problem and the public, Legislature and the

courts should all be made aware through proper educational channels of their responsibilities.

3. Many cities have assessed for combined sewers on the basis of the sanitary benefit to the property and ignored the storm sewer benefit. They have employed for this purpose a modification of the "zone and termini" system. Sanitary sewers have been assessed in the same way.

It is the conclusion of the committee that such a system is not a fair measure of benefit for storm sewers, and that an assessment based on area more fairly reflects the benefit conferred. This conclusion is on the premise that a sanitary sewer performs a more or less personal service, while a storm sewer drains water from property and the volume of such water and therefore the benefits are directly proportional to the area drained. We recognize that many factors can affect and vary this equation but these are, in our opinion, relatively unimportant.

Benefits to property conferred by both lateral and trunk storm sewers are dependent on topography and the benefits for the lateral sewer may extend a block or more away from the sewer or to the boundary of the drainage area of the nearest existing or proposed storm sewer. The determination of assessment limits for storm sewers serving flat areas may be difficult and of necessity somewhat arbitrary.

The benefits, generally speaking, are the same for each square foot of property. The lots directly abutting on the sewer, however, do derive a greater benefit by reason of the owner's ability to connect his drainage directly to the sewer, but this benefit is difficult to measure, particularly in view of the owner's reluctance to spend the money necessary to make such a connection.

Storm Sewer Design

4. Storm sewers should be designed not only to accommodate runoff from street area but also from property abutting thereon, or reasonably contiguous thereto. Storm sewers, contrary to the criteria established for the design of sanitary or combined sewers, should be built only to collect drainage at sump or critical points; it is not necessary always to construct the sewer

for the entire length of the street to accomplish satisfactory drainage. Costs can be substantially reduced by this method.

The City of Seattle recently compared the estimated cost of a certain storm sewer designed in accordance with the above standards with the cost of a storm sewer designed to accommodate all house connections; in other words, one similar to a sanitary sewer. The savings in this instance amounted to 41 percent, or \$326,300, exclusive of the direct cost to the property owner for side sewer connections, which, if considered, would increase this figure by a substantial sum.

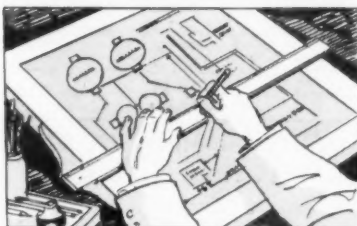
The provision of wyes as a part of the original construction of the sewer, in order to permit direct connection later of property drainage, is a needless waste of money. Few residential property owners will incur the expense to make such a connection and prefer either to discharge storm water through the curb onto the street surface, where it will find its way by gravity to the nearest inlet, or will make no effort whatever to care for storm drainage, leaving such water either to percolate into the soil or to find its way freely to some sump point, where an inlet may be available.

In certain California cities, only large buildings, parking lots or other hard-surfaced areas producing immediate runoff are required to provide connections directly to the storm sewer. Runoff from residential properties may, if desired by the property owner, be drained by proper conduits to the gutter line.

We do not necessarily approve this connection procedure from an engineering point of view but recognize that, economically, enforcement of direct connections would entail considerably greater expense to the owner not only for the connection itself, but also in the need to expand the design and scope of the sewer system to accommodate such connections. Wyes can be inserted later in the sewer line for any property owners desiring a direct connection. The owner, of course, should pay for the wye and its installation. The cost of such installation is nominal.

Adoption of the design standards herein recommended is contem-

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plated by the City of Seattle and if approved, could easily produce savings of several millions of dollars to the taxpayers in the newly annexed areas or in other locations where separate systems are required.

Financing Problems

5. In order to reduce assessing problems, it is highly desirable to determine well in advance of need the limits of drainage areas and to provide as near as possible in one system for the drainage of the entire area at one time. We recognize, of course, that this policy seldom can be realized completely.

6. We believe that in assessing for storm trunk sewers, it is not necessary to comply with the provision in the trunk sewer statute (R.C.W. 35.43.040, Section 7), which requires the use of the "zone and termini" method to determine the local benefits to the abutting property. The boundaries of the area of local benefit should be described, however, in the ordinance authorizing the improvement by a metes and bounds description in addition to the description of the boundaries of the trunk sewer district.

A finding also is necessary in the ordinance to the effect that the nature of the improvement is such that the special benefits conferred on the abutting or local property are not fairly reflected by the use of the "zone and termini" method and that a method has been employed which does reflect such benefits.

This same finding will also be required for all ordinances providing for lateral storm sewer improvements, if assessments are levied as herein recommended.

7. Sewerage utility revenues are intended by law (R. C. W. Chapter 35.67 and particularly Sections 35.67.010 and .020, as amended by Chapter 266, Laws of 1955) to be employed for the construction of sanitary and combined sewer systems, or for storm sewers "when the construction . . . and the maintenance, conduct and operation of the same is found to be necessary by the legislative body of the city or town for the proper and efficient operation of a system of sanitary sewerage disposal and treatment or the proper and efficient operation of a combined system of sanitary sewerage and storm or surface water disposal and treatment."

It is agreed that such revenues may not be used to construct storm sewers which have no relation to the sanitary system or which do not promote the efficiency of such a

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sanitary system. There is disagreement among committee members as to whether such funds can be used to construct a storm sewer as a relief facility in a situation where a sanitary system, either by improper construction or by lack of a proper exercise of police power, has become a receiver of storm water to the extent that the sewer is now in effect a combined system.

Some members, including the chairman, believe that cities have no such right—that the improper condition is brought about by failure of the proper officials to perform their duty in preventing the situation from occurring, and legal means are available to such officials to correct it. However, it may not always be politically expedient to employ such measures.

It is agreed that an ordinance authorizing the construction of a storm sewer which is to be financed with sewer utility revenues must contain a finding by the legislative body to the effect that said sewer is necessary to promote the efficiency of the sanitary or combined system.

While the legislative body must make such a finding, said body naturally must rely on its engineer for its information. Whether the engineer can make this finding must depend on the facts and, in the last analysis, on his conscience and professional integrity.

Legal counsel is of the opinion that while the Legislature undoubtedly has constitutional authority to enact legislation authorizing the financing of storm sewers by the issuance of revenue bonds, there is no practical way that charges can be made for storm water removal which will permit the issuance of such bonds.

8. City street funds legally may be used to construct storm sewers if the primary purpose of the sewer is for street drainage. General obligation bonds also may be used when authorized by the electorate for such purpose. This latter method seems to be the generally accepted plan of financing, other than L.I.D. A combination of L.I.D. with city aid is a more reasonable plan.

While some California cities, particularly those which have substantial volumes of storm water runoff during short periods of time, have had reasonable success in obtaining voter approval of general obligation bonds for storm trunk sewers, the committee is not at all optimistic as to the possibility of obtaining such funds.

Members of the Committee, in ad-

dition to Mr. Royal, are L. P. Staman, Director of Public Works of Tacoma; George S. McLean, Commissioner of Public Works of Wenatchee; George Fisher, City Engineer of Pasco; and C. S. Seabrook, City Engineer of Puyallup.

Highway Lighting and Nighttime Traffic Accident Relationship

Results of a recent two-year study of traffic accidents and fatalities on a three-mile stretch of urban highway have provided striking new evidence of the important role that adequate highway lighting plays in the reduction of nighttime traffic accidents.

A 32 percent reduction in nighttime accidents, a 38 percent drop in property loss, and the elimination of after-dark fatalities were brought about by the installation of modern highway lighting equipment, the study revealed.

Commenting on the results, A. E. Huber, Director of Traffic Safety for the State of Indiana, said: "It is important to keep in mind the fact that these reductions can be largely attributed to improved lighting since no other major preventive efforts were applied during the period of comparison."

Conducted by the Indiana Highway Department and Indiana State Police, the test covered a one-year period prior to installation of lighting and a similar period following installation. The area singled out for the study was on U.S. 40, a typical urban highway located near highly populated Indianapolis.

Highlights of the study reveal that nighttime accidents dropped from 100 to 68 following completion of the lighting system while daytime accidents remained about the same, 140 to 138. Only one fatal accident occurred along the three-mile stretch prior to the installation of fixed lighting. None occurred the following year.

Overall reduction in property loss amounted to \$20,616, dropping from \$77,756 to \$57,140. Although this figure represents the total decrease, officials estimate that approximately 75 percent or about \$15,500, of the amount came about as a result of the decrease in nighttime accidents.

To light the three-mile segment of U.S. 40, a total of 176 General Electric filament luminaires were mounted oppositely at intervals of approximately 125 feet and at heights of 30 feet. Six-foot brackets and steel poles were used.

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Light, Slow Speed

125 cfm Rotary Compressor

The light (2250 lbs.) and slow (1600 rpm) 125 cfm rotary portable air compressor announced by Le Roi, is a sliding vane type two-stage compressor with an in-line cylinder arrangement. It is powered, by direct drive, with a Le Roi engine which is a wet sleeve overhead engine. The engine-compressor is supported on a welded steel frame of unit construction and is enclosed in a lockable steel metal housing. Three-point suspension protects against towing distortion over rough terrain. Tool boxes are full length of housing, with no wheel-well interference. For more detailed information write the Sales Promotion Department, Le Roi Div., Westinghouse Air Brake Co., Milwaukee 1, Wis., or circle No. 12-6 on the reply card.

FWD Announces 40 New Snowplow Truck Models

Four Wheel Drive Auto Co. has announced new models that range from 26,000 to 55,000 pounds gross vehicle rating, and are equipped with a wide variety of gas and diesel engines, ranging from 150 to 335 hp. Twenty of the new models are equipped with double reduction axles and 20 with single reduction axles, to provide optimum power and efficiency in all types of snowplowing operations. The single reduction axle trucks are equipped with engines ranging from 150 to 240 hp. The double reduction axle trucks have engines of 180-335 hp. The new trucks may be equipped with virtually every type of snow removal equipment now in use, including all types and makes of V-type, one-way blade and rotary snowplows. They also can be used for other highway maintenance work, such as grading and hauling materials and equipment. For complete data write Four Wheel Drive Auto Co., Clintonville, Wis., or circle No. 12-7 on the reply card.

Road Roughness Tester

An inch-by-inch profile of the surface of a road, airstrip, or pavement area is now available from Soiltest. The unit consists of a test trailer, ramp, electronic controls and recording unit and a panel instrument truck. The trailer is towed by a specially modified panel truck at a constant speed (usually 20 mph). Variations on the pavement profile cause the sensitive test tire to raise and lower as it rolls along the pavement. This vertical movement is converted into electronic impulses which are relayed to the instrument panel in the truck. These data are recorded to provide a roughness index in terms of inches of roughness per mile. At the same time, an oscillograph recorder plots a permanent record of the pavement profile. Additional data on the tester may be obtained from Soiltest, Inc., 4711 W. North Ave., Chicago 39, Ill., or circle No. 12-8 on the reply card.

Air-Powered Sludge Pump

A new air-powered sludge pump, which can remove 42 gallons of sediment-filled water a minute at a 175-ft. head, has been announced by Thor Power Tool. The sludge pump, Thor No. 275, has no motor and its few working parts are stainless steel and automatically lubricated. Designed for continuous two-stage



breathing cycle, the pump draws in sediment by air suction until its tank capacity is reached, then automatically changes cycle to close the inlet valve, open the outlet valve, and expel the contents under pressure. Capable of entering an opening 18 by 12½ inches, the pump can draw in water containing sand, rock cuttings and other sediment up to a 20-ft. suction lift. For further details write the Thor Power Tool Co., 175 N. State St., Aurora, Ill., or circle No. 12-9 on the reply card.

New Mechanical Sludge Bed Cleaner

A one-man operated mechanical sludge bed cleaner with a capacity up to 3,100 square feet of sludge bed per hour, has been introduced by Link-Belt Co. which claims it permits savings of 60 percent annually over manual cleaning methods. Described as a conveying system on wheels, the sludge bed cleaner couples to a standard tractor for motive power. It consists of two hydraulically operated forked scoops, which, when raised, empty

into wing conveyors directly behind the scoops. These conveyors feed into a center longitudinal flight conveyor at a 45° incline. It discharges the sludge into a truck. Advantages are it is more economical, removes sludge with a minimum loss of filter bed sand, and is easy to couple and uncouple to a standard tractor. Additional information from Link-Belt Co., Dept. PR, Prudential Plaza, Chicago 1, Ill., or circle No. 12-10.



One-man operated sludge bed cleaner with a capacity up to 3,100 sq. ft. per hour

One-Step Photo-Positive Reproduction Paper

A development of a new "Photo-Positive" paper for one-step direct-positive reproduction of engineering drawings has been announced by Peerless Photo Products. The paper has a 100 percent rag content base stock, which gives the material high wet strength and improved dimensional stability, and provides the greatest degree of uniformity of transparency. The rag content base stock cuts easily, cleanly, and evenly, without tearing irregularly. The translucent material is wet-erasable without bleed or feather when new pencil or ink lines are drawn over the erased area. The emulsion has a fast printing speed, and a high silver content that produces an image of greater density, resulting in better contrast. For more data write Peerless Photo Products, Inc., Shoreham, L. I., N. Y., or circle No. 12-11 on the reply card.

New Garbage Loader



Garbage loader is shipped completely assembled making for easy installation

The Stratton Hydro-Garbage loader, announced by Stratton Equipment, is designed to replace the tailgate on a dump truck without interfering with the dumping operations or ordinary use of the truck. A powerful worm revolves in a heavy duty tube, crushing cans, bricks and other items usually collected with garbage and rubbish and continuously drives the load against a deflection plate pushing it to the front of the body. Power is furnished from the power take-off on the truck transmission through a hydraulic pump and motor. Simply dump the load in the large hopper and pull the safety bar which instantly controls the forward, reverse or stopping action of the worm. For more details write The Stratton Equipment Co., 2030 East 105th St., Cleveland 6, Ohio, or circle No. 12-12 on the reply card.



Speed loader is available with buckets ranging from 17½ to 21½ cu. yd. capacity

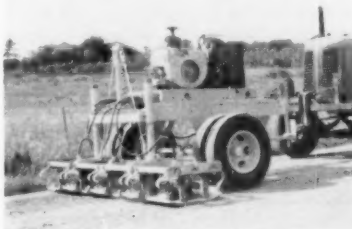
Koehring Speed Loader With 360° Turntable

The Skooper, announced by the Koehring Co., is the first speed loader to use the 360° turntable swing and a 7-ft. independent crowd feature. The dual steering wheels, brake pedals, throttles, pivoting seat and a 20 mph speed in either direction eliminates turning during hauling operations. Available with buckets ranging from 17½ to 21½ cu. yds. the Skooper has a cutting height of over 17 ft. Diesel power,

self-cleaning crawlers, enclosed gears, involute splined shafts, anti-friction bearings on all major shafts and an easily transported 8-ft. width are other important features. Easy change-over to a ½-yd. hoe, ¾-yd. clamshell or dragline or a 10-ton lift crane adds to the versatility. Write Koehring Co., 3026 West Concordia Ave., Milwaukee 16, Wisc., or circle No. 12-14 on the reply card for full details.

Jackson Trailer-Mounted Compactor

Jackson has mounted its vibratory pan-type compactors on a trailer that can be pushed or pulled by any prime mover capable of speeds as low as 50 fpm. Remote control permits the operator to raise and lower the workhead. New type bases permit operation in either direction and turning around or deadheading is obviated. Workhead may consist of 3, 4, 5 or 6 vibratory units, or two workheads of up to four units each in tandem may be employed. Each vibratory unit has its own motor, develops 6000 pounds of force at 4200 rpm and may be detached and used individually for compacting in confined areas. Further information from Jackson Vibrators, Inc., Ludington, Mich., or circle No. 12-13 on the reply card.



Pulse-Input Digital Recorder For Traffic Counting

Fischer & Porter announces a new digital recorder for traffic counting. Traffic flow during any preselected time interval may be readily measured. Operated by electrical impulses from a conventional road treadle, the new recorder produces a permanent record on punched paper tape. The tape recorder is easily interpreted visually or is suitable for use with automatic data processing machines. It is offered with standard time intervals of 5, 15, or 60 minutes. Other intervals are available and interval changes are easily accomplished by the user. Further information from Fischer & Porter Co., 911 Jacksonville Road, Hatboro, Pa., or circle No. 12-15 on the reply card.



Gradall has a 360° continuous swing working off either side or the rear

1 1/4 Yd. All Hydraulic Excavator

A new Gradall earth-moving machine has been announced by Warner & Swasey. This 1 1/4-yd. Model G-100 machine has a standard digging depth of 17 ft. which can easily be increased to 23 ft. with boom extensions. The reach of nearly 31 ft. can be increased to nearly 47 ft. with these same boom extensions. The machine has a continuous 360° swing and the ability to lift up to 14,000 pounds. Two 100 hp diesel or gasoline engines provide a constant supply of hydraulic power through two separate 3-section tandem pumps flange mounted directly to the engines. The fingertip hydraulic controls have been located at the sides of an adjustable padded seat to provide accessibility and ease of operation. Underseat provision is made for heating and air circulating equipment. The G-100 is quickly interchangeable from rubber tired carrier to crawler. Attachments available include a 48-in. wide excavating bucket, a 10-ft. wide clear span bucket for ditch cleaning, a 10-ft. wide bucket-blade, a pavement removal bucket, a ripper tooth, and two push type buckets of 1 1/4 yard and 2 1/2 yard capacity. For full details write The Warner and Swasey Co., 5701 Carnegie Ave., Cleveland, O. or circle No. 12-16 on the reply card.

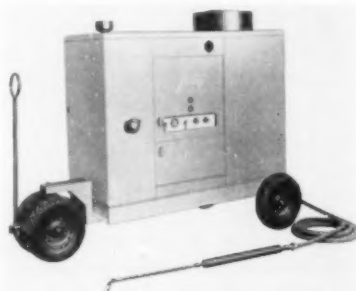
Base Spreader for Caterpillar Tractors

The John Ulrich U-100 base spreader attaches in minutes to any Caterpillar D8, D7 or D6 track-type tractor. Push fork arms slip onto the trunnions and are secured by one bolt on each side. The dozer blade serves as the strike-off. The spreader box is secured to the dozer blade by wing-nut clamps. Fast, accurate spreading in lifts from 1 inch to 20 inches are assured. Angle push fork arms provide maximum blade lift assuring full depth of spread. Width of spreads can be varied from 8 to 16 feet. Replaceable, 8-inch strike-off blades adjust to control edge of spread material and large push

rollers handle tandems of largest trucks. Caster wheels can be positioned in line with spreader box frame or to 10 ins. inside frame, providing easy truck entry. For complete data write John J. Ulrich Co., El Paso, Ill., or circle No. 12-17 on the reply card.

Steam-Hydraulic Cleaner

Heavy machinery and equipment is said to be cleaned from 4 to 6 times faster by the new "3500" Series Hypressure Jenny, a steam-hydraulic cleaner made by Homestead Valve. Instant choice of 11 different cleaning actions is possible by the movement of a single lever in the new unit. This has the dual advantage of giving the operator exactly the right pressure and gallonage for the job at hand, plus no



Being a steam-hydraulic cleaner means that the proper combination of heat, pressure, and cleaning compound is available for the cleaning job at hand

power waste. The 360-gph pump delivers only the amount required for any specific job. Outlet pressures and temperature are variable by the operator up to 300 pounds, and up to 325°F. It comes in trailer-mounted, shop portable, or stationary models with a choice of oil or gas for fuel. For more details write Hypressure Jenny Division, Homestead Valve Mfg. Co., Coraopolis, Pa., or circle No. 12-18 on the reply card.

Lightweight Paving Breaker

A new lightweight paving breaker is now being offered by Worthington. The 24-lb. tool is ideal for light utility work, trimming around man-holes and steel work, and brick and blacktop removal. Designed with a rubber buffer type retainer, the WB-24 has a front end with a smooth symmetrical contour for easy operator handling on side wall work. The tool cannot overheat because it is equipped with exhaust air passes in the front end. For further details write to Worthington Corp., Holyoke, Mass., or circle No. 12-19 on the reply card.

New Refuse Body By Heil



Pakomatic refuse body features the automatic push button control setup

A new truck body for the collection and packing of garbage, trash, and other refuse, has been announced by The Heil Co. This body loads from either side and packs the refuse to the rear of the body. Emptying of the body at the incinerator, dump, or landfill is accomplished by hydraulic ejection of the load through a rear tailgate, rather than by dumping. The unit is said to be exceptionally stable with unusually good weight distribution between the front and rear truck axles. It loads quickly and with a high degree of compaction through an independent, short packing cycle. For more data write Public Relations Dept., The Heil Co., Milwaukee 1, Wis., or circle No. 12-20 on the reply card.

Machine and Copy Paper Announced by "Thermo Fax"

A restyled Secretary copying machine, which makes completely dry copies of documents in less than four seconds, and a new heavy-weight copy paper have been announced by Minnesota Mining and Manufacturing Co. Called Type 30 Thermo-Fax copy paper, the new bond weight paper is durable and stiff to resist tearing and rough handling. The paper can be used in any existing Thermo-Fax copying machine as well as the new unit. More information from Dept. S8-316, Minnesota Mining and Manufacturing Co., 900 Bush Street, St. Paul 6, Minn., or circle No. 12-21 on the reply card.



Copy machine makes a completely dry copy of a paper in less than 4 secs.

Riding Attachment for Essick Vibrating Rollers

Essick announces the availability of a riding attachment for the VR-28W Roller, which converts this high-frequency self-propelled vibrating roller into a rideable unit. It is designed so that it can be quickly attached or detached, and allows the operator to control and operate the equipment while riding. Utilizing a frame of formed steel angles and tubing, the unit features a wetting pad and scraper bar on its roll wheel, a sprinkler tank, and a 16-in. x 24-in. operator's platform. All controls are conveniently positioned for the operator when using the attachment. For more data write Essick Mfg. Co., 1950 Santa Fe Ave., Los Angeles 21, Calif., or circle No. 12-22 on the reply card.

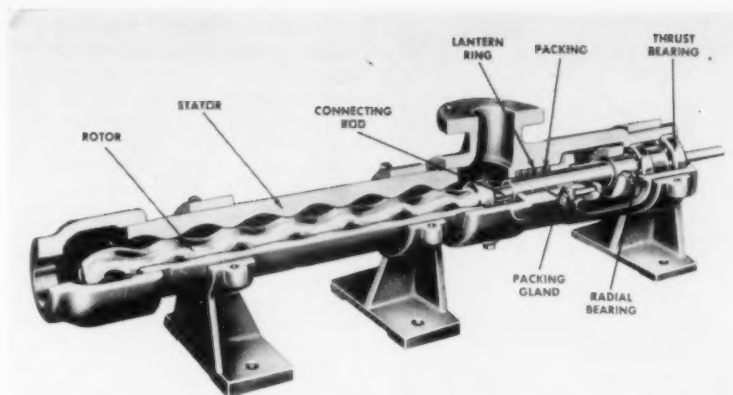
McCormick Rotary Cutters

Two new large-capacity McCormick rotary cutters, just announced by International Harvester, can be used with just about any 20 hp or larger tractor. The No. 27 trailing model cuts an 84-in. swath at any height from 3 to 14 inches. This big capacity adapts the No. 27 to large area operations: mowing along roads and highways, airfields, and even clearing brushy, lightly wooded



Rotary cutter for mowing along roads

areas. It can cut and shed brush up to 3 inches in diameter. The No. 28 low-deck rotary cutter takes a 60-in. swath and is available as a three-point Fast-Hitch model for use with IH tractors or as a three-point model for use with any two or three-plow size tractor with three-point hitch. Cutting height is regulated hydraulically by raising and lowering the tractor hitch. A gauge wheel can be mounted on the rear when the cutter is used on rough, uneven ground. For more data write Consumer Relations Dept., International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill., or circle No. 12-23 on the reply card.



This cutaway photograph shows the principal parts of a "progressing cavity" pump

Pump Handles Sludge and Rags In Sewage Treatment

The Moyno progressing cavity pump, which is similar in operation to a precision screw conveyor, has proven its ability to handle substances of high viscosity with solids in suspension. The pump was used in a test installation with the rotor being turned at 310 to 620 rpm by a 7½ hp motor. Inspection of the pump was initially made every 24 hours. Each inspection revealed some rags wrapped around the rotor

but never enough to lower the desired discharge rate of 80 to 160 gpm. The uniform discharge and constant pressure actually prohibited any grease build-up, removing another of the trouble spots. The pump ran for 19 months at full capacity and without a single maintenance problem. More information on this pump from Robbins & Myers, Inc., Springfield, Ohio, or circle No. 12-25 on the reply card.

Complete Line of Mechanical Seals

The Mechanical Seal, announced by Borg-Warner, is a shaft sealing device, used to replace the packing in a conventional centrifugal pump stuffingbox, or the gland of a rotating shaft. Using precision-lapped faces, it is designed to withstand extreme conditions of temperature and pressure without leakage. It is also said to eliminate the periodic down-time for repacking, as is associated with a conventional stuffingbox. Offered as a complete line, the seal is available for all makes, models and sizes of centrifugal pumps, as well as for other rotating shaft applications. Write Borg-Warner Mechanical Seals, P. O. Box 2017, Terminal Annex, Los Angeles 54, Calif., or circle No. 12-24 on the reply card.

Model 190 Backfiller Has Water-Cooled Throw-Out Clutch

A water-cooled throw-out clutch is a feature of the Cleveland 190 backfiller. Cooling is accomplished by a water jacket surrounding the clutch drum, with water supplied from the cooling system of the backfiller's engine. Another improvement

is the raising of the side boom hinges approximately 18 inches to a point above the crawler track. This provides more effective control and accuracy in throw-out and better control of the board in backfilling rocks, boulders, gumbo, etc. It also keeps the boom hinges out of muck, mud and water when the machine is backfilling in swamps, lowlands and other adverse conditions. It also has an improved front-end power take-off for its hydraulic system. For more details write The Cleveland Trencher Co., 20100 St. Clair Ave., Cleveland 17, Ohio, or circle No. 12-26 on the reply card.



Boom hinges are above the track providing better control in backfilling, keeping hinges clear of mud and muck



Unit for testing iron in city water

Tester for Iron Content

A new midget iron tester, designed for fast, easy and accurate determinations of iron content in water and brine, has just been introduced by W. A. Taylor & Co. Compact and rugged, the testing unit consists of 8 color standards, to cover the 0—10 ppm iron range, housed in a transparent plastic block; a glass comparison cell; two reagents with droppers; a mixing tube; a cell cleaner and complete instructions for use. The range of the color standards can be extended by diluting the sample with iron-free water. Tests for total iron are made simply by filling the mixing tube with the water or brine to be tested, and adding the reagents. After allowing this solution to stand for 15 minutes, it is placed in the tester block and compared with the color standards. Values are then read directly from the standards. For more information write W. A. Taylor & Co., 7300 York Road, Baltimore 4, Md., or circle No. 12-27 on the reply card.

Barber-Greene Batch Plants

Barber-Greene has just announced the addition of two new asphalt batch plants to their line; the Model 890, with 1,000 lb. rated capacity, and the Model 891, with 1,500 lb. rated capacity. Both new plants are basic 4-bin units designed for the production of all types of bituminous mixes and both incorporate many features of the company's larger "BatchOmatic" plants. Both also feature a degree of rugged construction surpassing conventional plant design. Equipped with a separate meter and pump, the system may be pre-set to deliver any amount of asphalt required for a batch. Once set, there is no need to re-set for succeeding batches of the same

specification. Merely pushing the button supplies the correct pre-set amount for each batch. To serve the 4-bin design, both models are equipped with a 3 1/3-deck vibrating screen, fitting either to handle a full range of asphalt mixes at top capacities. The controls of the plants have been designed for maximum operator ease and convenience. Also, extensive use of hydraulics is made in the plant controls; the pugmill gate is hydraulically operated, providing instant discharge of the full pugmill load and elimination of segregation. For more details write Barber-Greene, Aurora, Ill., or circle No. 12-28 on the reply card.

Bennett Bilt Drum Tops

The new Bennett Bilt Model 63 drum top converts any 30 gallon grease drum (or any drum with maximum diameter of 19 3/4 ins. to 16 3/4 ins. minimum diameter) into a self-closing waste receptacle producing a sanitary, fire-resistant litterbug eliminator. Self-closing chromium plated top door with unusually gentle spring action make depositing refuse so easy that cleanliness and neatness are automatic. Top opening is protected by a rubber gasket for silent door action and eliminates both sharp edges and possibility of cutting hands while depositing waste. The unit is ideal for outdoor or inside locations with phosphate treated heavy gage steel and special outdoor baked enamel finish. For complete information write to the Bennett Mfg. Co., Alden, N. Y., or circle No. 12-29.



Sweepster Jeep Brooms



Sweepster can handle 5 to 6 ins. of very wet snow at speeds up to 10 mph

Available for the old and new Jeeps, cab forward Jeep trucks and practically all makes of tractors the Sweepster Jeep Brooms are made by Sweepster Inc. They are easy to install, and can be used for clean-up, black-top patching, snow removal work and other maintenance operations. The brooms are offered in sizes of 5, 5 1/2 and 6 feet. Brush diameter is 32 inches, sweeping path 12 inches less than broom width and sweeping angle 31° right side. For full details write Sweepster Inc., 13900 Livernois, Detroit 38, Mich., or circle No. 12-30 on the reply card.

Construction Equipment Mechanics School

A new type of school to train skilled mechanics for the earthmoving industry will soon be opened by the Greer Technical Institute which, 20 months ago, pioneered a school to train earthmoving equipment operators and which has since turned out over 1,000 graduates. Located in Wilmington, Illinois, about 60 miles from Chicago, the school will require 540 hours of training over a period of 10 weeks.

In the Construction Equipment Mechanics course instruction will cover Diesel engines, fuel injection systems, torque converters, final drives, steering systems, tractor tracks, cable controls, welding and bulldozer rebuilding. It is the aim of the school to provide practical and technical training for students to help meet the need for skilled manpower required to service and maintain earthmoving equipment.

Health Department Checks Private Swimming Pools

The Health Department of Columbia, S. C., inspects swimming pools at motels, institutions and, on request, in private yards. Circulation, drainage and chlorine residual are checked and water samples for analysis are taken at three depths.

LETTERS

TO
THE EDITOR

A ROBOTRY APPLICATION

In looking over the October issue of "Public Works" I was interested in the article "Robotry in Water and Sewage Works Operation" and thought you might be interested in the control panel used in the large Pontiac Motor Division waste treatment plant which we designed and built.

In this plant to treat 1.75 mgd of plating wastes, there were five separate waste lines, so we arranged the panel in five sections, each independent of the other so that the operator assigned to a given treatment section need pay attention only to the controls on his section. The five sections, as identified by nameplates at the top, were "Cyanide System", "Alkali-Acid System", "Metallic-Acid System", "Alkali-Oily System" and "Final Treatment".

All push buttons for operating every unit in the plant (96), and all tank level indicators and pH recorders were on the panel. It was entirely graphic so an operator could follow all flows.

The basic design was mine and we built the panel completely in our own shops here in Toledo. An interesting feature of the level controls for the 20 tanks provided with this service was that special switch arrangements were provided to stop and start the motors of the agitators with which each tank was provided when the impeller was properly submerged. This to prevent running improperly and to save power. Also at the approach to maximum and minimum tank levels warning lights and alarms were provided.

I have always wanted to provide such a panel for sewage plants but this was the first real opportunity to work it out on a plant scale.

E. B. Besselièvre, Manager
Industrial Wastes Division
K & H Engineering Company
Toledo, Ohio

Experienced Technical Sales Representative Available

A man with 20 years top level experience in sales work for nationally known engineering design, industrial and construction firms is available. He has had experience in and is thoroughly familiar with sales planning and organization, sales division administration and customer relations. The New Jersey-Pennsylvania-Connecticut area is preferred. Known to and recommended by the Editor of Public Works. Write to Box C-12, Public Works Magazine, 200 South Broad St., Ridgewood, N. J.

• • •

Sales Representatives Wanted By Manufacturer

A manufacturer of a very useful small hoist, 1/2-ton capacity, which is truck-mounted and operated from the truck battery, desires sales representatives who contact cities and counties. These hoists are utilized by many departments, as street and highway, water, sewerage, fire, park, etc. Write to Burchaell Heating Co., 2944 SE Powell Blvd., Portland, Oregon, for full details on this labor and time-saving device, including special applications.

• • •

41st Annual Meeting of the National Slag Association

The 41st Annual Meeting of the National Slag Association was held in Washington, D. C., on October 21-22, 1958. The annual banquet was held on the evening of October 21, in the Mayflower Hotel. There were approximately 100 guests present with Charles W. Ireland, Vice President, of the Association, presiding. Francis C. Turner, Deputy Commissioner and Chief Engineer, Bureau of Public Roads, was the guest speaker for the evening. E. W. Bauman is the Managing Director of the National Slag Association.

• • •

California Chapter, American Institute of Planners

The California Chapter of the AIP will meet in San Diego, Calif., at the U. S. Grant Hotel, on Feb. 6-8, with a full program of general sessions, workshop groups and field trips. Further data from Harry C. Haelsig, Director, City Planning Dep't., San Diego, Calif., or from Jerrold R. Allaire at the same address.

CLASSIFIED ADVERTISING

SEWAGE TREATMENT PLANT EQUIPMENT FOR SALE

The treatment of sewage for the Village of Arlington Heights, Illinois has been taken over by the Metropolitan District of Chicago. Consequently, the completely equipped trickling filter type sewage treatment plant, designed to handle the needs of a municipality of 40,000 is to be sold. This plant has been in operation for only five years, and all of the equipment is virtually like new.

The Village will sell any or all of its equipment, including motors, pumps, filter stone, sludge collectors, etc., for the best offer. Upon request the Village will furnish a detailed list of all equipment and any other information as to equipment removal, shipment, and terms of purchase. Address all correspondence to Norman J. Toberman, Village Engineer, Village Hall, Arlington Heights, Ill., by January 1, 1959.

Sales Representatives Wanted

A manufacturer of a very useful small hoist, 1/2-ton capacity, which is truck-mounted and operated from the truck battery, desire sales representatives who contact cities and counties. These hoists are utilized by many departments, as street and highway, water, sewerage, fire, park, etc. Write to Burchaell Heating Co., 2944 SE Powell Blvd., Portland, Oregon, for full details on this labor and time-saving device, including special applications.

SALES ENGINEER AVAILABLE

Graduate C. E. with more than ten years background in management and promotion of sales in water and sewer fields desires position of responsibility and potential. Write Box 12-2, Public Works, 200 South Broad St., Ridgewood, N. J.

VILLAGE ENGINEER

Full time staff position in growing Chicago suburb of 17,000. Salary open. Graduate Civil Engineer required. Council-Manager type of government.

Write to:

Box 12-1

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Following three reprints are being offered at special reduced prices.

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PUBLIC WORKS JOURNAL CORP.

200 So. Broad St., Ridgewood, New Jersey

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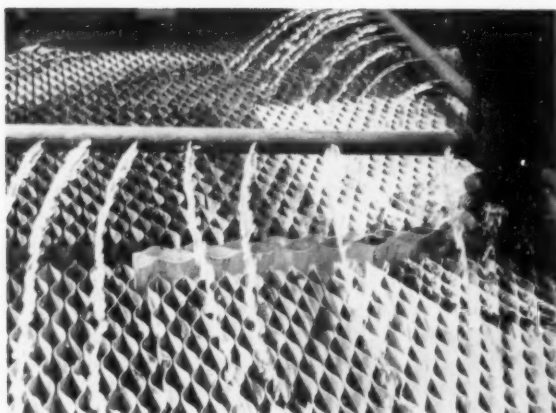
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 Arthur K. Akers,
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ADVERTISING OFFICES

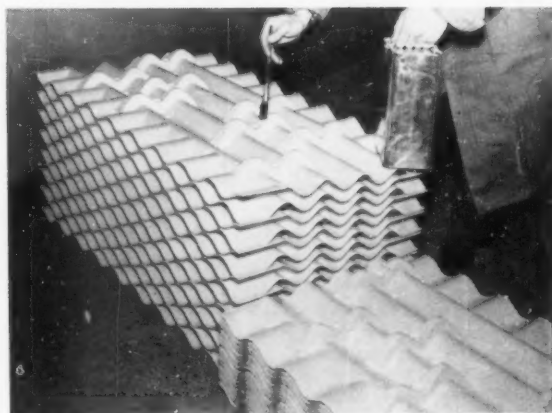
Ridgewood, N. J., 200 So. Broad St. W. S. Morris, <i>Eastern Sales Mgr.</i>	Los Angeles 36, Calif. 5478 Wilshire Blvd. Hugh Hollyday, % Smith & Hollyday David W. Zander
Cleveland 10, Ohio, Villa Beach 2, 15445 Lake Shore Blvd. Burton M. Yost, <i>District Mgr.</i>	San Francisco 4, Calif., Russ Building Bill Smith, % Smith & Hollyday
Chicago 11, Ill., 612 N. Michigan Ave. Robert J. Shea, <i>Mid-West Sales Mgr.</i> Roderick Ellis	Kansas City 15, Mo., 4117 West 67th C. H. Stockwell

—Worth Seeing

What appears to be a cushion for the bottom of this International Drott 4-in-1 bucket is really a huge tire of the type used on heavy construction equipment on its way to a burial in a Colorado Springs sanitary landfill area. This versatile tractor handles daily refuse from 16 trucks at the fill and has no trouble keeping ahead of the dumping trucks.



The new wrinkle in trickling filters is Dowpac, a product of the Dow Chemical Co. Manufactured from either polystyrene or saran, depending on the chemical resistance required, the corrugated sheets may be assembled in self-supporting units and can be stacked as high as 42 ft. Waste flows in excess of 800 mgad have been applied without restricted air circulation.



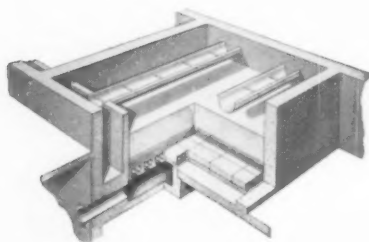
The city of St. Paul, Minn., makes year-around use of its two new Thew Moto-Loaders, which are equipped with all-weather cabs. In summer they handle rock and sand for oiling streets and in winter they load rock salt for snow and ice control.



Shown left to right are APWA officials, W. D. Hurst and Sol Ellensen, receiving a color film documentary of modern public works in action from L. W. Pierson, manager, IHC motor truck sales and M. F. Peckels, IHC director of consumer relations.

Only **Leopold** GLAZED TILE FILTER BOTTOMS

**Successfully meet
all underdrain
requirements**



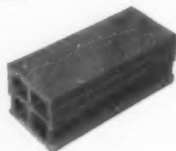
Filter unit showing Leopold Filter Bottom and Leopold Fiberglass-Reinforced Plastic Wash Trough

**Performance Proved in
over 375 plants with a
daily capacity of more than
2½ billion gallons!**

In this design, laterals and distributing blocks form a permanent unit that assures equal filtration and uniform wash distribution with low loss of head. Made of de-aired fire clay—vitrified and salt glazed—the blocks can't corrode, won't absorb water, are acid and alkali resistant, and are not subject to tuberculation.

In addition, the Leopold Filter Bottom needs only a shallow depth of small-sized filter gravel, does not require supporting concrete structures, and is the only design providing a fixed and controlled secondary backwash.

Literature
and Complete
Details
Furnished
on Request!



Leopold
F. B. LEOPOLD CO., INC.
Zellenople, Pa.

**COMPLETE WATER TREATMENT
PLANT EQUIPMENT**



by Arthur K. Akers

★ **WITHOUT** hesitation, with the leaves still on the trees as we write it, we wish you one and all a very Merry Christmas, and the sort of a New Year that the business forecasters now clearly see!

★ **J. B. CLOW and SONS'** new pipe plant at Bensenville, Ill., has been placed in operation, as the last word in pipe making. For how it looks, see their advertising "spread" in this issue of **PUBLIC WORKS**.

★ **DORR-OLIVER's** new offices in Stamford, Conn., are unfolding as a thing of beauty, architecturally. Native ores and minerals submitted by each of the nine D-O subsidiaries are embedded in the mosaic floors, to name just one striking feature. We aim to get out there and see it.

★ **SOLVAY PROCESS DIVISION** promotes Harry C. Todd to the new-



Mr. Todd



Mr. Cannon

ly created post of manager of distributor sales. William J. Cannon will succeed him as advertising manager.

★ **A. S. MARLOW** has been named president, Midland Products Co., Midland Park, N. J., producing new-design self-priming centrifugal and diaphragm pumps.

★ **SOUTHERN CLAY PIPE INSTITUTE, Inc.**, Atlanta, announces that Lewis A. Young has been appointed secretary-manager, at 206 Mark Building.

★ **ARTHUR F. WOODS** is newly-titled general sales manager of Marlow Pumps Division, Bell & Gossett Co., following additions to his responsibilities as sales manager.

★ **FRINK SNO-PLOWS INC.**, Clayton, N. Y., elected George W. Kenyon, president; Howard Reiman, vice president; and Holland S. Frink, son of founder Carl Frink, vice president—sales. We, too, like to think of all the additional snow plows the new interstate highway program will demand.

★ **AUBURN MACHINE WORKS**, Auburn, Neb., is on the expansion road, too, with appointment of Don E. Moore as regional sales manager in the eleven Western states. He was formerly sales and advertising manager, Earth Equipment Corp., Los Angeles.

★ **CHARLES W. IRELAND**, president of Vulcan Materials Co., Birmingham, becomes president of the National Slag Association. E. W. Bauman continues as managing director of the Association in Washington.

★ **SOILTEST, Inc.**, Chicago, names James J. Steur to the newly created post of marketing director. Mr. Steur's interesting career to date fills a whole page.

★ **J. STANFORD SMITH** moves up to general manager of the General Electric Company's Outdoor Lighting Department in Hendersonville, N. C. Mr. Smith writes us "we are out to really light up America!"

★ **ARTHUR W. OSTRANDER** has been elected vice president for sales, General Metals Corporation, Oakland, Calif. He will continue to manage sales for the subsidiary Enterprise Engine Co. of San Francisco.

★ **HAL LOWTHER** is named general sales manager, Ottawa Steel Division, Young Spring & Wire Corp., Ottawa, Kansas.

★ **"FILL HER UP,"** directed the driver of the block-long 1959 model to the Mississippi filling station attendant. Some time later came a plaintive plea from said attendant: "Boss, is you mind shuttin' off your engine? You is gainin' on me."

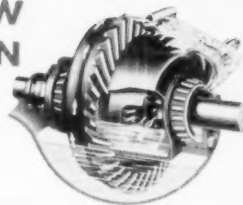


PLANETARY GEARING

—distributes pressure and wear over four planetary gears, resulting in lower unit stress, reduced maintenance, longer axle life.

FORCED-FLOW LUBRICATION

—supplies positive lubrication to all moving axle parts, even at slowest vehicle speeds.

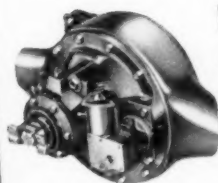


SELF-CONTAINED AIR BRAKE

—provides for greater braking efficiency; quick action and quick release; quick easy reline. Available on Eaton air brake models.

POSITIVE SHIFT CONTROL

—on 2-speed models, provides quick, easy shifts. Drivers use available gear ratios—the right ratio for each road and load condition.



EXTRA-RUGGED CONSTRUCTION

—eliminates the possibility of harmful distortion or misalignment under full load, holds maintenance to a minimum.

INDUCTALLOY AXLE SHAFTS

—handle more pounds of torque without fatigue failure; last 3 to 10 times longer. Keep trucks on the road, reduce maintenance expense.



These EATON AXLE Features Save Money for Truckers

The advanced features built into Eaton's practical, down-to-earth axle designs add up to rugged dependability, less shop time, easier maintenance, longer axle life. They enable truck operators to get the most out of their hauling equipment at lowest possible cost. Ask your truck dealer for complete information.



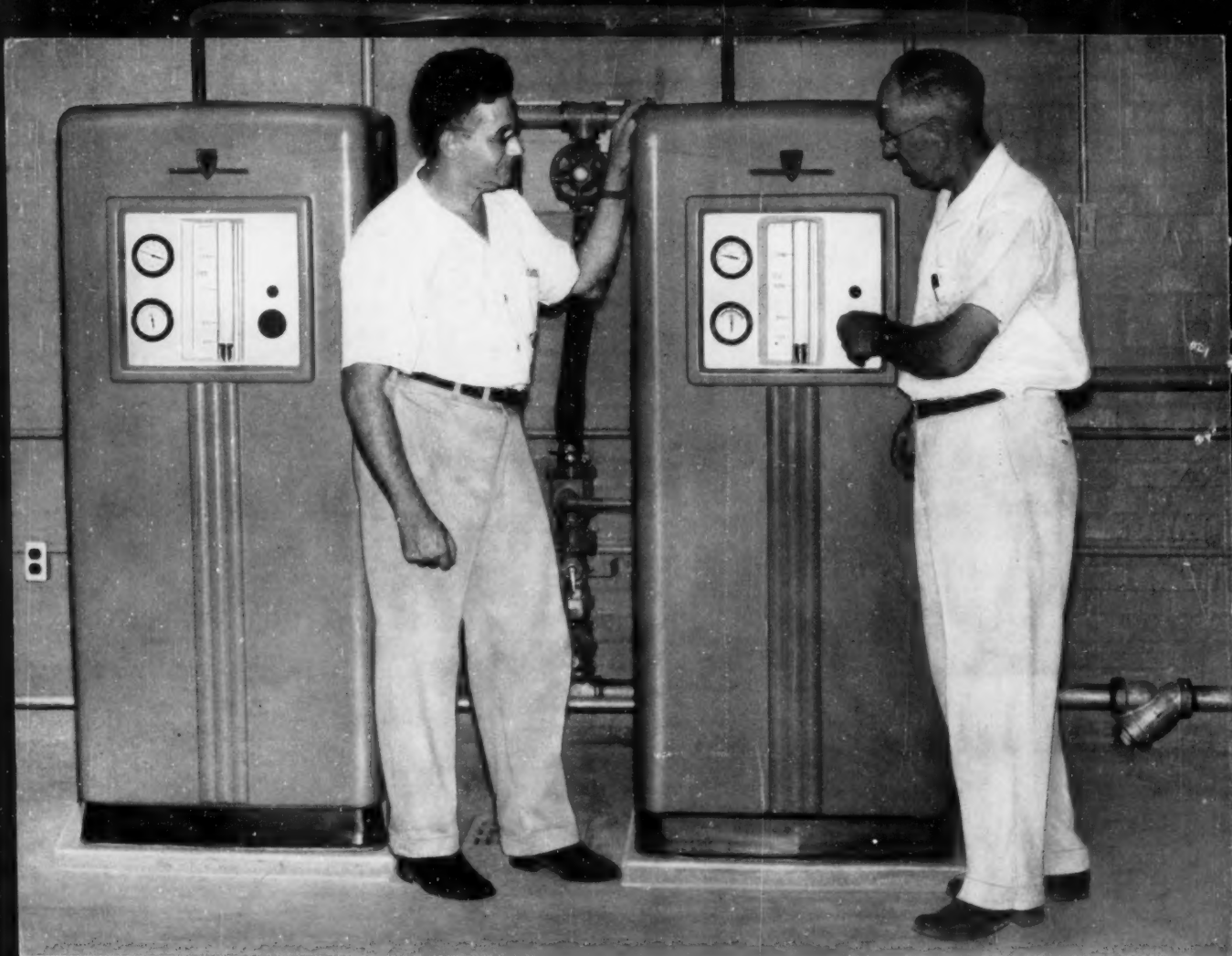
More than Two Million
Eaton Axles in Trucks Today

EATON

AXLE DIVISION
MANUFACTURING COMPANY
CLEVELAND, OHIO



PRODUCTS: Engine Valves • Tappets • Valve Lifters • Valve Seat Inserts • Jet Engine Parts • Gears • Hydraulic Pumps
Truck & Trailer Axles • Truck Transmissions • Permanent Mold Iron Castings • Automotive Heaters & Air Conditioners
Fastening Devices • Cold Drawn Steel • Stampings • Forgings • Leaf & Coil Springs • Dynamatic Drives & Brakes



J. Pauli, Chief Engineer and W. Johnson, Chief Chemist of the St. Joseph, (Mo.) Water Company, discuss operation of their W&T V-notch chlorinators. The St. Joseph Water Co. is part of the American Water Works Service Co., Inc. system.

W&T V-notch Chlorinators— doubly accepted

The St. Joseph Water Co. found breakpoint chlorination the best way to treat Missouri River water. But this increased the range of chlorine requirements in the water treatment. W&T V-notch chlorinators were the answer.

W&T V-notch chlorinators have a chlorine feed range of 20 to 1 with an accuracy of 4%. Based on this acceptance at its St. Joseph plant, the American Water Works Service Co., Inc. has purchased V-notch equipment for use in other plants.

V-notch chlorinators are available to feed from $2\frac{1}{2}$ to 8000 pounds of chlorine per 24 hrs. V-notch equipment also provides permanence and attractiveness through modern reinforced plastics. For comprehensive information about W&T V-notch chlorinators, write for Bulletin S-119.78.



WALLACE & TIERNAN INCORPORATED

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